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AN EXAMINATION OF CLEANING AND GAS FREEING COSTS OF OIL TANKERS IN GOVERNMENT SERVICE

by

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March 1994

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The objective of this thesis is to attempt to reconcile Military Sealift Command's (MSC) and Defense Fuel Supply Center's (DFSC) different points of view with respect to tank cleaning on tankers in government service. Currently, petroleum tankers in government service have extensive requirements to clean and gas-free cargo tanks prior to loading other petroleum products. However, to save money and avoid disposal complications, the MSC periodically requests waivers from the DFSC to not clean and gas-free cargo tanks. These waivers are usually requested when the last product carried may be compatible with the next product to be loaded. DFSC infrequently grants these waivers primarily due to quality concerns and liability issues. MSC's and DFSC'S perspectives are presented and then compared to Chevron Shipping Company's (CSC) operations. The practices of government and commercial tanker operations are compared and analyzed. Finally, conclusion and recommendations are presented.

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by

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ABSTRACT

The objective of this thesis is to attempt to reconcile Military Sealift Command's (MSC) and Defense Fuel Supply Center's (DFSC) different points of view with respect to tank cleaning on tankers in government service. Currently, petroleum tankers in government service have extensive requirements to clean and gas-free cargo tanks prior to loading other petroleum products. However, to save money and avoid disposal complications, the MSC periodically requests waivers from the DFSC to not clean and gas-free cargo tanks. These waivers are usually requested when the last product carried may be compatible with the next product to be loaded. DFSC infrequently grants these waivers primarily due to quality concerns and liability issues. MSC's and DFSC'S perspectives are presented and then compared to Chevron Shipping Company's (CSC) operations. The practices of government and commercial tanker operations are compared and analyzed. Finally, conclusion and recommendations are presented.

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I. INTRODUCTION

A. BACKGROUND

Petroleum tankers in government service have extensive requirements to clean and gas-free cargo tanks prior to loading other petroleum products. However, to save money and avoid disposal complications, the Military Sealift Command (MSC) periodically requests waivers from the Defense Fuel Supply Center (DFSC) to not clean and gas-free cargo tanks. These waivers are usually requested when the last product carried may be compatible with the next product to be loaded and when the time between cargoes is less than three days. DFSC infrequently grants these waivers primarily due to quality concerns and liability issues.

B. OBJECTIVE

The objective of this thesis is to attempt to reconcile MSC's and DFSC's different points of view with respect to the tank cleaning issue. MSC asks "how much longer can the present frequency of tank cleaning continue to be justified in view of the consequent high costs?" On the other hand, DFSC believes that cleaning tanks is absolutely essential to maintain quality in the carriage of clean petroleum products, particularly aviation fuels. DFSC feels any savings to the government by ***not*** cleaning tanks rarely outweigh the risks and costs that may be incurred in handling the disposition of an off-specification product load.

C. SCOPE

The focus of this thesis is clean petroleum product quality requirements and the nature of tankers' operations in government service. Significant focus was placed upon waste disposal complications which arise from tank washing operations. However, alternatives to handle subject waste at Department of Defense fuel support facilities were not covered, other than to communicate recommendations from MSC activities and operators. Finally, commercial tankers that carry refined products were examined to compare the similarities between theirs and the government's quality concerns, tank washing practices and waste disposal experiences.

D. METHODOLOGY

The methodology of this thesis is as follows: personal and phone interviews, literature research and tanker inspections with government Quality Assurance Representatives.

E. PREVIEW

Chapter II will examine MSC tanker operations by focusing on tasking, and the nature of cargo tank cleaning. Also, the type of charters for tanker vessels will be discussed. Finally, issues germane to the tank cleaning issue will be presented. Chapter III explains DFSC's mission in fuel management. It focuses on quality control checkpoints relevant to the movement of clean petroleum products in MSC tankers. It also presents rationale behind the importance of fuel quality. Chapter IV focuses on Gas-Free Waiver Requests submitted by MSC to DFSC. It cites MSC's justification for not cleaning tanks and it presents DFSC's perspective in

granting those requests. Chapter V presents Chevron Shipping Company's (CSC) practices with regards to the carriage of clean petroleum products. Suggestions for the government are presented with regards to how CSC approaches like problems. Chapter VI extensively examines the problem of slops disposal, which is a function of the amount of tank cleaning performed. Chapter VII analyzes issues of tank cleaning and slops, and provides comparisons with commercial practices. And, finally, Chapter VIII summarizes the thesis effort and presents conclusions and recommendations.

II. MILITARY SEALIFT COMMAND TANKER OPERATIONS

A. OCEAN TANKERS

The MSC operates a fleet of clean product[1] tankers used by the DFSC in support of Department of Defense (DoD) demands. Presently, the MSC tanker fleet consists of sixteen handy-size tankers and two smaller size tankers. A handy-size tanker is one with a capacity of 200,000 barrels, which equates to approximately 27,500 deadweight tons (DWT). [Ref. 2:p. 2] Such tankers are likely not to encounter restrictions in port depth or handling facilities. The breakdown of tankers is as follows: five T-5 (Champion) Class tankers, nine Sealift Class tankers, and two Offshore Petroleum Discharge (OPDS) tankers. (See Appendix A) Figure 1 shows a Sealift Class tanker.

MSC is responsible for obtaining the vessels and paying all costs associated with their operation. MSC charters these ships under three types of contracts: bareboat, time, and spot charters. A bareboat charter is a contract for the exclusive use of a ship for a defined period of time, with MSC being responsible for crewing, operating, supplying, and servicing the ship. A time charter is a contract for the use of a ship and its crew for a specified period of time, with MSC paying the owner a fee to operate it and reimbursing the owner for fuel costs and port charges. [Ref. 3:p. 2] All of the Sealift Class tankers are operated

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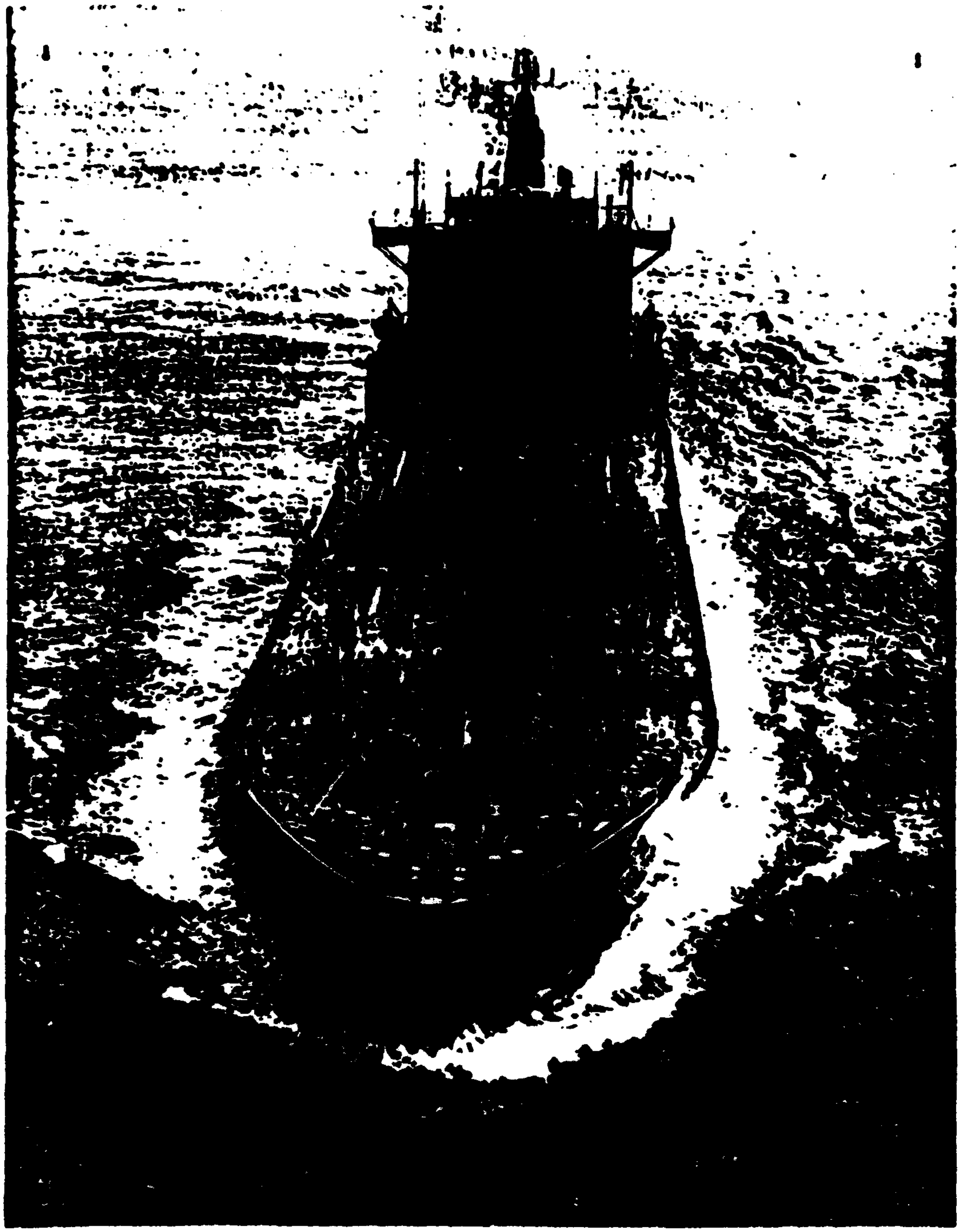
[1]Clean Oils are refined oils, either colorless or light colored. [Ref. 1:p. xxii]



Strategic Sealift Force tanker USNS Sealift Mediterranean

Figure 1. Sealift Class Tanker [Ref. 6]

under a bareboat charter and the T-5 Class tankers are operated under a time charter [Ref. 4]. Finally, there is a spot charter, which is a contract, at a fixed fee, for a little as a single voyage, where the owner operates the ship and pays for all costs out of the fixed fee. A spot charter would be appropriate when petroleum lift requirements reveal shortfalls in transportation assets. [Ref. 5:p. C-2-1]

During FY 1992, 18 tankers were under charter to MSC and were supplemented by 5 spot chartered (single voyage) tankers. Presently, all the tankers are U.S. flagged. This force moved approximately 8.2 million tons of petroleum products around the world for DoD users. [Ref. 6:p. 18]

MSC operations are financed through the Defense Business Operations Fund (DBOF). In 1991, DBOF absorbed the Navy Industrial Fund and became a revolving fund which provides working capital for MSC operations. MSC earns revenues to cover its expenses similarly to private industry by charging government agencies, such as DFSC, or services provided for them. For the service of chartering, DFSC pays MSC a per diem rate for each tanker. This rate is then adjusted each fiscal year [Ref. 7]. Ultimately, MSC channels these payments back into the DBOF, which is designed to break even [Ref. 8:p. 1]. DFSC centrally manages the handy-size tankers because they routinely cross sub-organizational boundaries in moving from supplier refineries to discharge storage terminals around the world. These sub-organizational boundaries are the Defense Fuel Regions (DFRs) and Joint Petroleum Offices (JPOs), who do not have the world-wide perspective of DFSC. [Ref. 7]

Establishing cargoes based on an integrated analysis of available operational information, DFSC attempts to manage petroleum transportation

on a least overall cost to the government basis. In addition to the acquisition cost of fuel, a transportation surcharge is also added in DFSC's cost collection. Once cargoes are established by DFSC, DFSC tasks MSC with tanker missions. MSC assigns vessels from the existing fleet described earlier to move cargo loads. (See Appendix A) If more tankers are required by DFSC, additional tankers are spot-chartered by MSC for individual or multiple cargoes [Ref. 4].

Tanker missions are determined based on customer requirements called slates. These slates are sent to DFSC on a monthly basis from the Defense Fuel Regions (DFR) in the Continental United States (CO and the Unified Command Joint Petroleum Officer (JPO) or designated DFR's overseas. Factors that determine slates for petroleum products necessitating tanker missions include inventory position at tanker terminals throughout the world, contingency needs, upcoming exercises, and requirements to meet minimum contract lifts. [Ref. 7]

Basic principles of tanker management from DFSC Operations and Inventory Branch (DFSC-OII) are to "First, meet all operational requirements. Secondly, maximize tanker use by filling vessels to capacity and limiting the number of load and discharge ports during a single cargo." [Ref. 7]

B. CARGO TANK CLEANING REQUIREMENTS

The types of tank cleaning of tankers in government service are as follows [Ref. 9:p. 3]:

1. Maintenance cleaning;
2. Cleaning and gas-freeing for tank inspection or minor repairs;

3. Cleaning and gas-freeing for shipyard overhaul or major repairs;
4. Cleaning for change of cargo;
5. Cleaning after a contaminated cargo;
6. Gas-freeing in preparation for loading;
7. Cleaning in preparation for ballasting; and
8. Cleaning prior to inactivation and activation;

The frequency and thoroughness required of maintenance cleaning will depend on the nature of service provided by the tanker, the results of tests on previous cargoes[2], the use or non-use as a ballast tank, and the type of tank coating. [Ref. 5:p. 3]

When cleaning for a change of cargo, the extent of cleaning will depend upon the preceding cargoes and the next product to be carried. If the change of cargo is to a similar product, such as JP-4 to JP-8, a routine water washing may be sufficient. [Ref. 9:p. 4] This method utilizes a pump, salt water heater, and associated piping to deliver salt water at the required temperature and pressure for tank washing.

Since some products have persistent qualities, previous cargoes, other than the last cargo carried, must be considered. Some examples of persistent qualities of concern are such thing as dyes, flashpoints, and freezepoints of the preceding products. Dyes will adhere to bulkheads and discolor the next product. And, products, even in small quantities, can affect the succeeding product's flash and freezepoints. For example, diesel fuels adversely affect jet fuels' freeze points. Appendix B

[2] Samples of cargoes are retained at testing facilities for at least 60 days in accordance with MIL-HDBK-200G. Previous tests might be referred to if rust/sediment content was high on a particular tanker. [Ref. 10]

identifies in further detail previous cargoes and the effects of contamination on succeeding cargoes. [Ref. 9:p. 4]

On the other hand, when cleaning after a contaminated cargo, the issue becomes more complex. The first step is to find the nature and cause of contamination. Contamination may have resulted from an inadequate rinse, failure to use an interim load of a petroleum solvent such as diesel oil, or the entrapment of the contaminating agent behind blisters, scale or faulty doubler plates [Ref. 9:p. 5]. For example, inadequately rinsing after carrying a load of gasoline may affect the flashpoint and explosibility of a succeeding cargo of JP-5 [Ref. 9:p. 41].

Currently these tankers in government service have extensive requirements to clean and gas-free their cargo tanks prior to loading. Guidance for tank cleaning is delineated in three instructions: The Defense Logistics Agency Manual (DLAM) Instruction 4155.1; "Petroleum Contract Quality Assurance Manual." [Ref. 11], the MIL-HDBK-200G, "Quality Surveillance Handbook for Fuels, Lubricants, and Related Products." [Ref. 10]; and the MIL-HDBK-291(SH) "Military Handbook for Cargo Tank Cleaning," [Ref. 9] which supersedes NAVSEA 0900-LP-016-0010 (to be discussed later). MIL-HDBK-291(SH) is the first order of precedence for tanker operators. The objectives of the instructions are to avoid serious consequences of contaminated cargoes, loss of life resulting from unsafe practices, and economic loss when cargo tanks do not meet prescribed standards of cleanliness. [Ref. 9:p. iii] Each of the three instructions contain tables that give specific guidance for tanker operators based upon the last product carried and the next product to be loaded. These tables are Table II in DLAM 4155.1 [Ref. 11], Table VI. in

MIL-HDBK-200G [Ref. 10], and Figure 25 in MIL-HDBK-291(SH) [Ref. 9] (See Appendices C, D, and E). The first two tables are nearly identical and defer in some instances to Appendix E, Figure 25 [Ref. 9:p. 67] for specific actions required. For example, when going from carrying Lube Oil to carrying Aviation Gasoline (Avgas), Tables II and VI specify code "D" which states, "Cargo tanks will be processed in accordance with the instructions contained in NAVSHIPS 0900-016-0010 Manual for Cargo Tank Cleaning," which, as explained above, has been superseded by MIL-HDBK-291(SH). On the other hand, required actions can range from cold/hot water washings to being prohibited from switching to different kinds of service, such as switching from carrying grain to jet fuel.

Of interest to this thesis is the nature of tank cleaning operations when switching from the following carriages:

1. Jet to jet.
2. Jet to diesel.
3. Diesel to jet.
4. Diesel to diesel.

Jet fuel and diesel fuel products make up 41.6% and 32.9%, respectively, of the total tanker workload [Ref. 6:p. A-9]. Thus, it is worthwhile to focus on products that account for 74.5% of the tankers' work. However, the reader must realize that Table VI, "Guide for preparation of cargo tanks" (Appendix D) lists at least nine types of jet fuel and eleven types of diesel fuel. Some of these products have common chemical characteristics like equal flashpoints, such as 140 degrees Fahrenheit (F) in the case of JP-5 and F-76. However, commonality among refined products' characteristics is rare. Fuels have many unique

characteristics such as specific gravity, water separation index, and flash point. A short review of each of these characteristics will give the reader an appreciation for their significance.

Specific gravity is the ratio of the weight of a given volume of material at 60 degrees F. to the weight of an equal volume of distilled water also at 60 degree F. It is important in the gauging of the liquid content of tankers. A change in a fuel's specific gravity may indicate a change in its composition caused by mixing with residues of the previous fuel carried in the tank [Ref. 10:p. 62].

Water separation index reflects the ease with which a fuel releases dispersed or emulsified water. Water in fuels will adversely affect the performance of all engines [Ref. 10:p. 65].

The flash point of a product is used to determine whether a product is contaminated. It is primarily applicable to lower temperature boiling range products such as diesel fuel and JP-5. For example, minute quantities of gasoline will lower the flash point of diesel fuel considerably below the minimum safe operating level.

As a result of the uniqueness of petroleum characteristics, Reference 5 cites special tank cleaning requirements, especially for loading jet fuels. First, it cautions Masters against ballasting cargo tanks unless operationally necessary. This is because aviation fuel filters installed in aircraft carriers cannot remove all the contaminant which is formed in stable emulsion by JP-5, water, and rust. Furthermore, the presence of water removes anti-icing additives which are added to JP-5 by the refinery during onload of a tanker.

MIL-HDBK-291 (SH) [Ref. 9] details specific actions for tanker operators for the product changes listed above. The following exchanges are summarized from Reference 9, Figure 25, "Cargo Tank Cleaning Requirements" in Table 1. (See Appendix E for full explanation.) (Also, see Appendix F for descriptions of fuel types.)

C. SAFETY PRECAUTIONS

Cleaning and gas-freeing a tanker is hazardous for many reasons and is one of the riskiest operations a tanker crew must do. Figure 2 shows the results of a tank cleaning accident. Aside from hazardous atmospheres, dangers exist from falls, and hot water burns and bruises received from operating tank washing machines. The primary concerns for crews are the dangerous physical characteristics of the petroleum vapors and that explosive gases may be present. An empty tank will, over time, pass through a nonexplosive condition when its vapors/gases are too rich to explode, then through an explosive condition and, finally, through a nonexplosive condition when the vapors are too lean to explode. [Ref. 9:p. 5] Since these gases are heavier than air, gases expelled from a tank may also accumulate about the deck, creating a hazard in a seemingly safe area. Therefore, personnel must be cognizant of wind speed across the deck for it plays a very important part in the dispersion of hydrocarbon gas from tanker vents. If the wind speed exceeds about 10 m.p.h. experience suggests that dispersion is rapid and flammable gas mixtures do not occur except in the immediate vicinity of vent openings. [Ref. 1:p. 34] Specific precautions that crews must also observe when explosive vapors are present above deck are securing weather deck openings

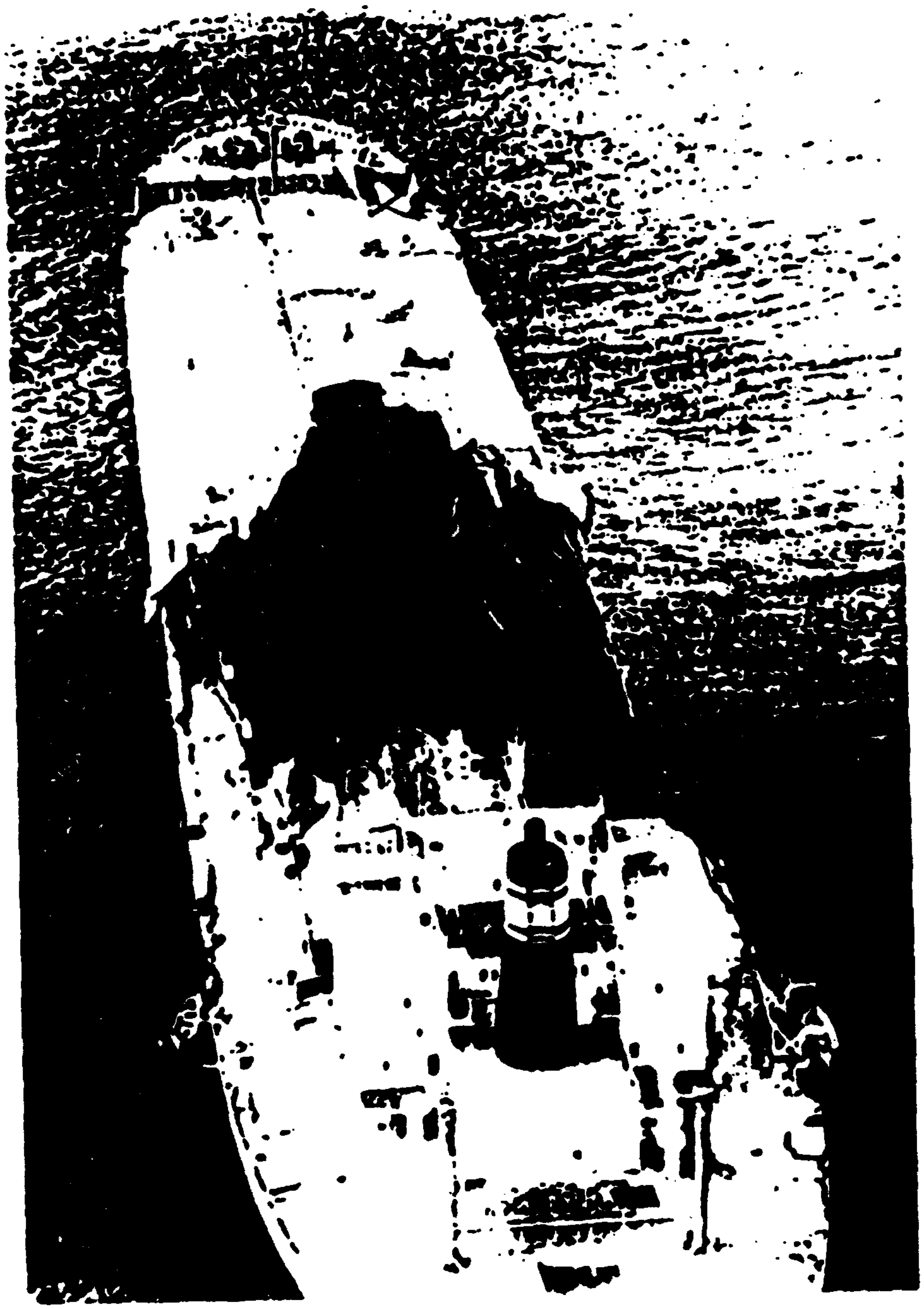


Figure 2. Tank Cleaning Accident [Ref. 12]

TABLE 1. TANK CLEANING SUMMARY

	NEXT PRODUCT	
LAST PRODUCT	JET	DIESEL
JET	DROP LINES[3], BOTTOM WASH TANKS, HOSE AND WIPE TANKS, FLUSH LINES, CLEAN STRAINERS.	NO SPECIFIC PREPARATIONS IF LINES HAVE BEEN DROPPED AND TANKS STRIPPED.
DIESEL	HOT WASH TANKS, BLOW OUT STEAM LINES/HEATING COILS, THEN SAME AS ABOVE.	SAME AS ABOVE.

to prevent ingestion of gases into internal spaces (such as the engine room), grounding the tanker to the pier with an approved bonding cable to prevent static electricity buildup at hose connections, and absolutely prohibiting smoking, electrical appliances, and wireless transmitting devices. [Ref. 9:p. 6]

Another potential source of danger stems from steam and mist, which may be present in a tank after washing because such moisture is likely to contain a strong electrostatic charge. No objects, grounded or otherwise, should be lowered into a tank containing steam. [Ref. 12:p. 185]

Aside from the explosive danger from petroleum products, the vapors also have toxic effects that cause dizziness and possible loss of balance. Furthermore, certain chemical components and additives in petroleum warrant special consideration. [Ref. 9:p. 7] Some of these include sulfur, which can lead to the formation of hydrogen sulfide and organometallic gasoline additives such as lead tetraethyl, which can vaporize

[3]Cargo is loaded through filling lines called drops. Therefore, "dropping" consists of running tank washing machines down loading lines that serve individual tanks.

along with the gasoline vapors and have a poisonous effect on human physiology. [Ref. 9:p. 7]

Reference 9 states, "Except in an emergency, personnel shall not enter a tank or other compartments subject to vapor accumulation, until a qualified chemist or ship's officer (designated as the gas-free engineer) has tested the space, and then only upon the direction of the officer-in-charge."

Three classifications are used for defining tank atmospheres. They are "Not Safe for Personnel - Not Safe for Hot Work" (hot work is defined as welding, flame cutting, or any spark producing activity), "Safe for Personnel- Not Safe for Hot Work," and lastly, "Safe for Personnel- Safe for Hot Work." To enter tanks just for inspection MIL-HDBK-291(SH) requires, as a minimum, that the tank be certified "Safe for Personnel- Not Safe for Hot Work." Essentially, this means there is oxygen in the optimum range of 20 to 22%, hydrocarbons or other gases in excess of toxicity limits are not present or likely to be evolved, but there is danger from explosion due to the existence of flammable material. [Ref. 9:p. 2]

D. CARGO TANK CLEANING PROCEDURES

Tank washing on the tankers in government service is accomplished with tank washing machines, followed by manual "mop up" called mucking. The tank washing machine is a hydraulically rotated nozzle device attached to a hose and inserted in the tank. It is small, self-contained, and constructed of nonferrous metals to eliminate the possibility of spark generation. As the nozzles automatically turn slowly about the horizontal

and vertical axis, their positions change continually during each revolution, causing the streams to strike all surfaces either directly or indirectly. The motion of the jets is controlled with mechanical precision, resulting in a more thorough job than would be possible by hand washing. Furthermore, with hand washing, it is not possible to utilize the high pressure and temperature which can be handled by the machine, let alone the fact that manually washing completely, even one tank, would take an extraordinarily long time. The type of machine most commonly utilized is the Butterworth (type K). [Ref. 9:p. 15] Durable and reliable, this device weighs about 30 pounds and provides high quality washing (See Figure 3).

After a cargo tank is washed it must be ventilated and gas-freed prior to personnel entry. Ventilation is accomplished by either forcing gases out of the tank by blowing or by extracting gases with suction. This gas-freeing ventilation is normally carried out at sea, at an approved explosive anchorage, or at a pier designated as an authorized cleaning station. [Ref. 9:p. 10]

Once tests indicate a safe atmosphere, the tanks are inspected to determine the quality of machine washing and the extent of manual washing, if any, which may be necessary to achieve the desired quality. These operations might include further machine washing, spot washing, hand hosing and mucking. Mucking consists of removing scale, sediments, and sludge accumulated on the tank bottoms or internals prior to and during routine washing. Accomplished by scraping, sweeping, and then shoveling the debris into buckets for disposal, this operation is extraordinarily labor intensive, and can consume considerable valuable time during a

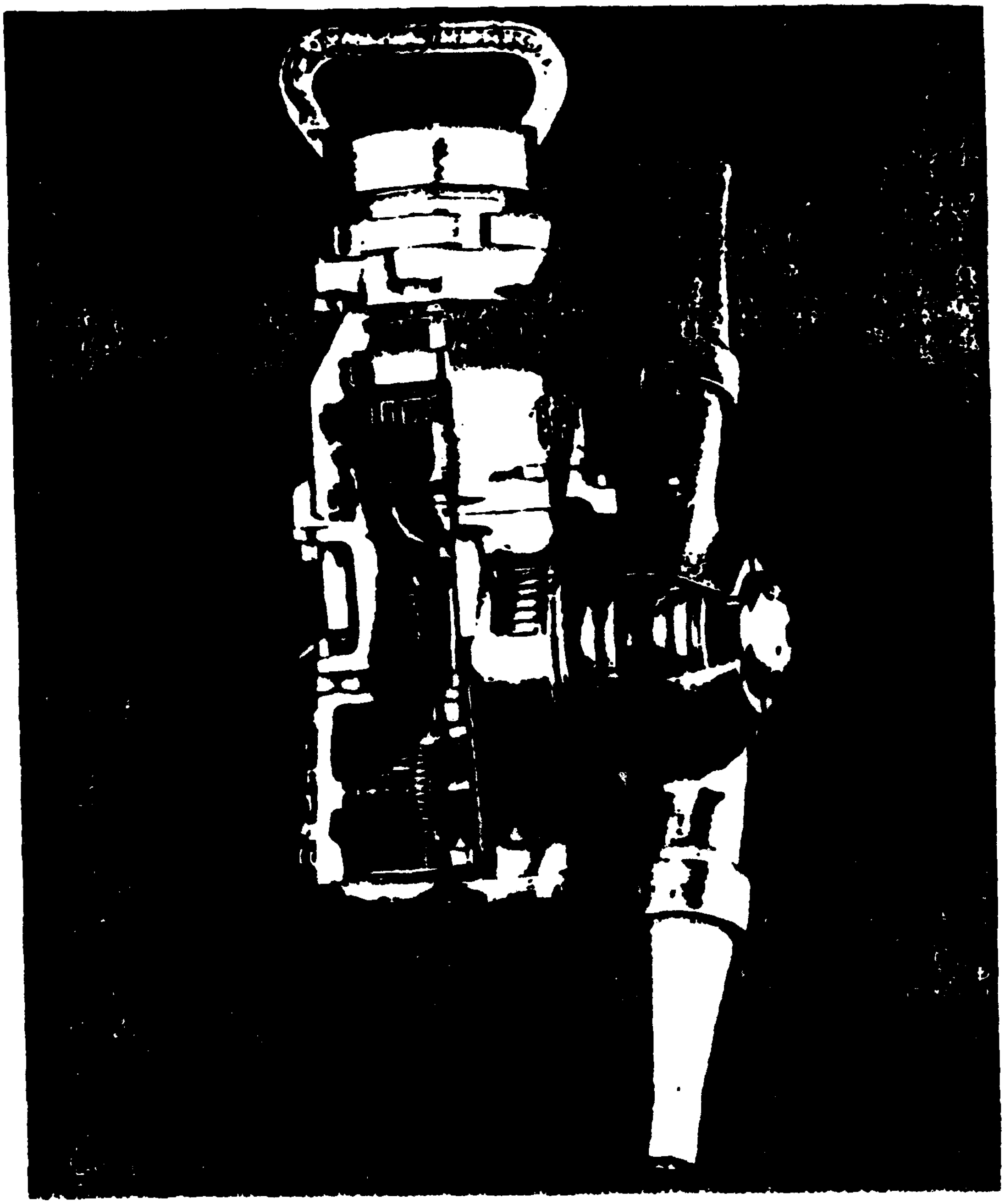


Figure 3. Butterworth Tank Cleaning Machine [Ref. 12]

voyage. [Ref. 9:p. 27] Figure 4 should give the reader an appreciation for the magnitude of a tank cleaning job in just one tank.

As a result of cleaning tanks, oily waste is generated. This waste, called "slops," is a mixture of tank washings consisting of previous cargoes' residues, water and sediments. The issues associated with the disposition of slops will be discussed in the Chapter VI.

Naval Ships' Technical Manual (NSTM), Chapter 593, defines oily waste as "any liquid petroleum product mixed with water at the ratio of 20 parts/million or greater oil in water, or oil in any amount which, if discharged, would cause a sheen on the water." [Ref. 13:p. 5] Slops are collected onboard in a designated slop tank. Any discharge in-port or at-sea must be done in accordance with NSTM 593, which defers to the Oil Pollution Act of 1990 (OPA of 1990). The OPA of 1990 defines at-sea discharge limits by the "*minimum prohibited zone*," which is the area between a coastline and 50 miles out to sea. No slops may be discharged in this zone. [Ref. 13:p. 5] The OPA of 1990 originates from legislation passed by the United States in response to public reaction to the ***Exxon Valdez*** spill and other tanker accidents that followed it. [Ref. 12:p. 249] Additionally, hazardous materials and waste remaining after separation techniques, such as decanting (discussed later), have specific restrictions regarding disposal. Examples of some hazardous materials are heavy metals and detergents that originate from engine room greases and lubricants.

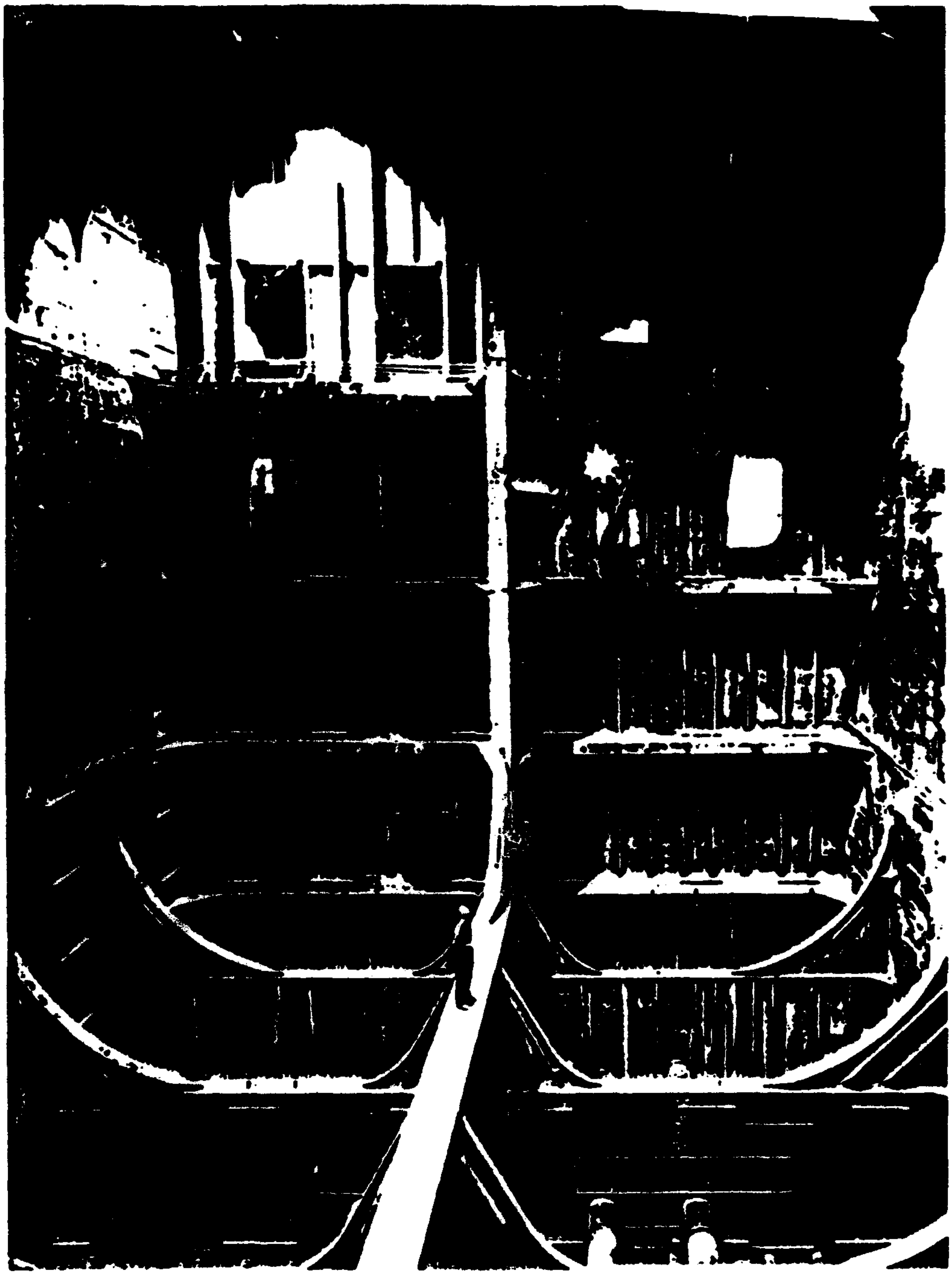


Figure 4. Liquid Cargo Tank [Ref. 12]

E. MILITARY SEALIFT COMMAND CHARTERS

As discussed earlier, the T-5 and Sealift Class Tankers are operated under a time and bareboat charter, respectively. The contracts awarded by the Operating Contracts Division of the Military Sealift Command, Central Technical Activity (MSCCENTACT) are unique in that they are firm fixed-price contracts with cost reimbursable elements. For instance, the per diem rate to operate and maintain the ship, which includes crew wages, subsistence, minor repairs, etc., is a fixed rate for the period of the contract. Other costs like fuel, tank cleaning, overtime, port charges, major repairs and overhauls are unknown initially, and are reimbursed to the contractor as they occur over the life of the contract. [Ref. 14:p. 11] MSC's ultimate goal in awarding time and bareboat charters is to meet DoD's transportation requirements at the lowest cost [Ref. 3:p. 15].

MSC also awards spot charters when regularly scheduled commercial carriers or, in the case of tankers, MSC controlled ships cannot meet DoD's short term transportation requirements. The reasons for using spot charters to solve lift shortfalls include the quantity or type of cargo to be transported, the location at which the cargo is required, the requesting activity's time frames, or a combination of these factors. When MSC seeks a spot charter it competes on the commercial spot market and is, therefore, subject to the competitive forces of the market at the time. Consequently, the costs involved in spot charters are influenced by the number and types of ships available to sail to a particular location as well as the ship's suitability for carriage of the cargo. [Ref. 3:p. 16]

Time and bareboat charters carry the vast majority of petroleum, even in times of extraordinary demand, which was the case in FYs 1991 and 1992 during Operations Desert Shield and Desert Storm. Figures 7 and 8 illustrate the proportion of lifts conducted by charter types [Ref. 6:p. A-5].

Regardless of the type of charter MSC employs, MSC attempts to get the right ship for the right job and ensure that it is fit for the mission. Reference 5 (p.C-2-49) discusses the required steps for pre-charter inspections and the criteria for ship acceptance. A time-charter contract generally specify that the commercial operator will provide a safe ship capable of carrying the cargo intended to be loaded for required lifts. [Ref. 5:p. C-2-49] Specifically, the charter contract states,

> The owner shall, before and at the commencement of any voyage hereunder exercise due diligence to ensure that the vessel's [systems]... are *fully functional and in good working order and* condition and in every way... fit to carry and preserve the Cargo... [Ref. 15:p. 6]

Furthermore, the charter contract goes on to require,

> The owner warrants that the Vessel's cargo tanks shall be acceptable to receive the cargo identified, ... acknowledging the guidance set forth in Attachment J1 herein.[4] [Ref. 15:p. 7]

To ensure that MSC can verify a vessel's readiness, the charter contract has a clause which states that the vessel is subject to the charterer's inspection prior to acceptance and at any time during the charter period. These inspections are performed in accordance with the Oil Companies International Marine Forum Publication <u>Inspection Guidelines for Bulk Oil Carriers (1st ed. 1989).</u> [Ref. 15:p. 8]

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[4]Attachment J1 is MIL-HDBK-291, "Cargo Tank Cleaning Requirements," Reference 9.

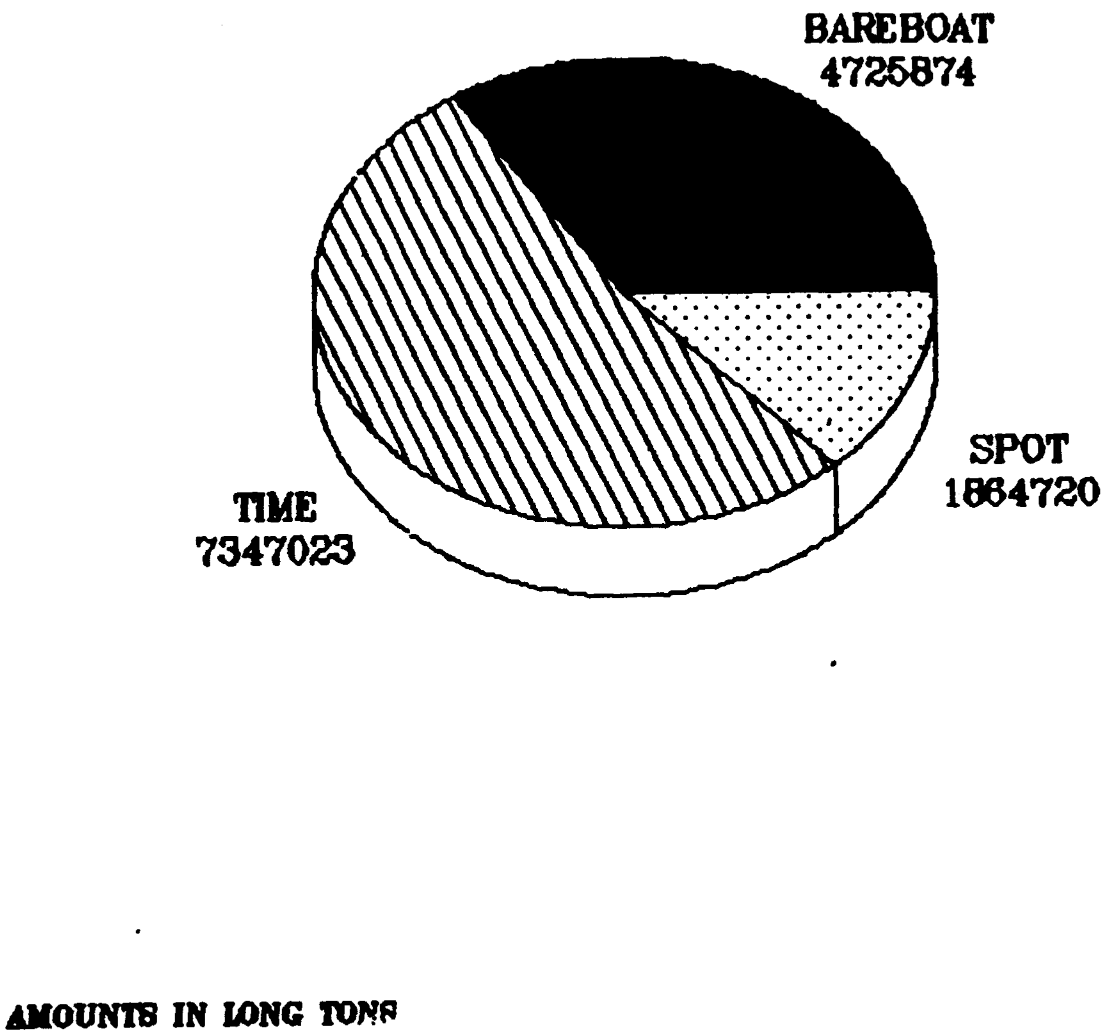

Figure 5. Petroleum Lifts By Charter Type FY 1991 [Ref. 6]

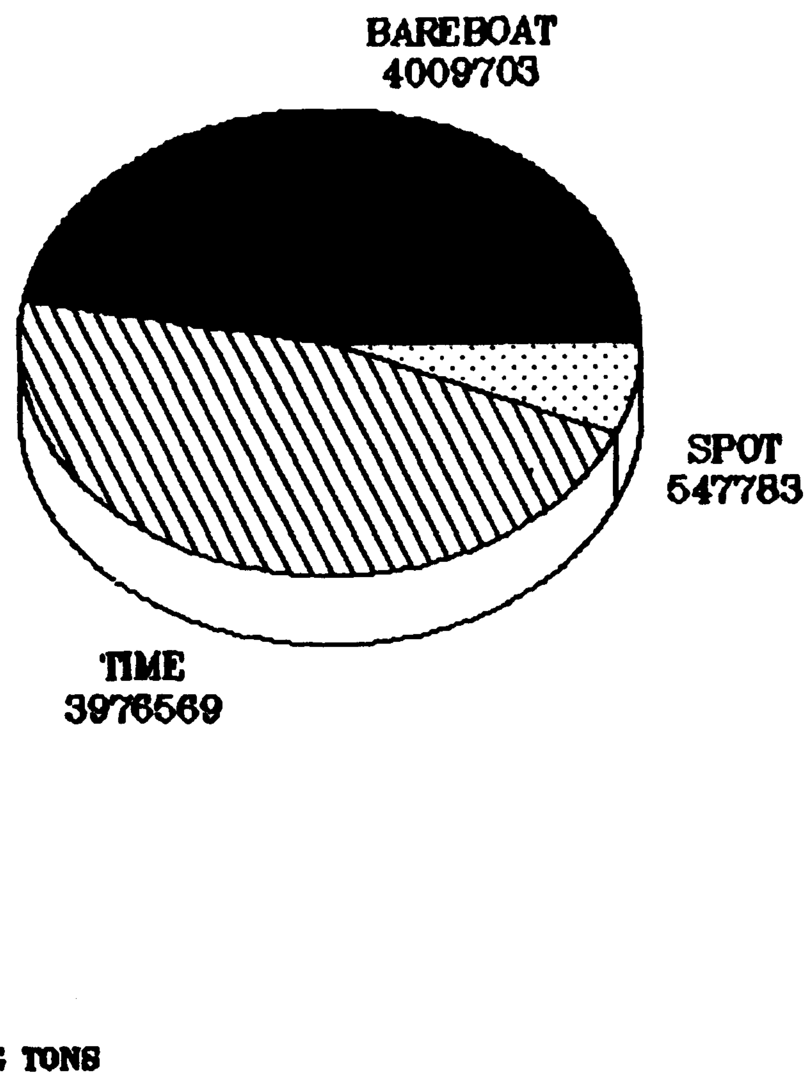

Figure 6. Petroleum Lifts By Charter Type FY 1992 [Ref. 6]

Also, the charter contract establishes MSC's right to demand additional cleaning (and gas-freeing if required) at the vessel's owner's expense in order to satisfy MSC [Ref. 15:p. 8]. And, MSC has the right to survey and take samples of the vessel's bunker tanks [Ref. 15:p. 8].

Lastly to cover any possible contingency, the vessel's owners are required to maintain effective marine insurance coverage on their tanker. Specifically, in the case of the T-5 and Sealift Classes, Reference 15, paragraph H15.1, lines 1361 to 1365, states,

> In the case of Vessels sized 20,000 long tons summer dead-weight or more, Owner's P & I[5] insurance shall provide coverage against liability for cargo loss/damage for an unlimited liability amount per incident, ...

Thus, sufficient coverage does appear to be present in MSC tanker charter parties to hold operators of government service tankers liable for product damage (in this case, contamination, proven to have occurred onboard).

F. ISSUES

MSC has several issues with respect to what they feel can be excessive tank cleanings required by DFSC, particularly when tanks are required to be cleaned when onloading the same product that was just discharged. First is the cost and difficulty in disposing of tank washings' waste or slops. Chapter VI is devoted entirely to this issue.

Secondly, tank cleaning costs money. Because of the nature of the charters, extra time to clean tanks can be measured in monetary terms of

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[5] P & I stands for Protection and Indemnity which is a form of insurance that provides security against damage or loss.

extra fuel, oil, and crew pay. These costs are elements of the per diem rate MSC charges DFSC for operating and maintaining a ship. During a tanker's charter, the amount of these costs is not entirely predictable. In MSC's Gas-Free Waiver Requests, these costs are delineated for DFSC's benefit in order to assess costs incurred in the interest of quality. [Ref. 4] DFSC will consider these costs, but DFSC does not have sufficient incentives to consider reducing costs since the division making the decision on the waiver is strictly concerned with *quality*. Ultimately, these costs are added as components of the transportation surcharge on the price of fuel DFSC charges its customers.

The third issue is that of delays. A full ship cleaning requires an average of three days. Some transits are so short between product change-outs that delays sometimes occur. For example, in the case of tankers which are performing *shuttle operations* in areas like the Mediterranean Sea, extra time has to be taken to remain at sea to conduct a full tank cleaning. [Ref. 4]

The last two issues deal with the material readiness of the tankers in government service. First, tank coatings suffer from repeated exposure to hot water washings. And lastly, crews involved in tank cleaning cannot perform maintenance without encroaching into overtime budgets.

G. CONCLUSION

The T-5 and Sealift Classes of tankers are the work horses for moving DoD clean petroleum products. Because of DoD activities' insatiable demand for fuel and a limited tanker supply, these tankers are constantly being tasked to move a variety of clean petroleum products throughout the

world. Strict guidelines for tank cleaning are published by the Defense Logistics Agency (DLA) that allow the tankers to remain flexible for the next product to be carried. The guidelines seek to preserve a new cargo's integrity from the lingering effects of a previous cargo. Consequently, tanker operators must regularly wash and gas-free tanks. These evolutions are dangerous and risky . Tank cleaning and slops disposal demand strict compliance with safety precautions and environmental laws. In response to DLA guidelines MSC charters vessels in a manner that ensures operators embrace all the aforementioned aspects through clauses that place liability for conformance on the operators.

MSC has concerns about the strictness of the DLA guide-lines. The main concern is the frequency and costs of tank cleaning. MSC seeks to save money and time by submitting Gas-Free Waiver Requests. This issue will be discussed in detail Chapter IV.

The issue of DLA's modifying tank cleaning requirements for government service tankers is complex because MSC and DFSC have both common and unique concerns. However, the practices of tank cleaning reveal some inconsistencies where modification and communications may yield improvements in cutting costs. These inconsistencies will become apparent in subsequent chapters.

III. DEFENSE FUEL SUPPLY CENTER

A. BACKGROUND

The Defense Logistics Agency (DLA) is the logistics arm of the DoD. Several supply management functions are performed by DLA supply centers. DFSC is responsible for contracting for all fuels required for all branches of the military services as well as some federal civil agencies. Its collective mission is to provide the right fuel of the right quality and quantity to the proper place at a fair price. More specifically, Quality Assurance experts, coded DFSC-Q, ensure that products are procured to the proper specification and provide guidance on product specification waiver requests during contract performance. Additionally, DFSC-Q furnishes direction and guidance in technical matters to JPOs, DFRs, and Defense Contract Management Commands (DCMCs) [Ref. 10:p. 2].

The total dollar amount of fuel purchased by DFSC Contracts and Production (DFSC-P) is quite significant. In fiscal year 1988 (FY88), the purchases were $4.52 billion. The top ten DFSC contractors (in FY88) were Shell Oil Company, Chevron USA, Inc., Atlantic Richfield, Mobil Corporation, Exxon Corporation, Coastal Corporation, Bahrain National Oil Company, Standard Oil of Indiana, Motor Oil Hellas, and Sun Company, Inc.

Once contracts are let by DFSC-P, they are overseen by Defense Contracts Management Command (DCMC). DCMC utilizes Quality Assurance Representatives (QARs), who participate in a program called Government In-Plant Quality Evaluation (IQUE). The primary objective of IQUE is to

ensure acceptance of conforming products. QARs work with specific contractors to gain a spirit of teamwork and continuously improve processes and resulting product quality. [Ref. 16]

Petroleum products procured by the government receive the highest of three levels of quality assurance. The QA requirement is defined by Military Standard, MIL-I-45208A. This military standard requires the contractor to establish an inspection system in accordance with specifications and to perform tests and inspections necessary to substantiate product conformance. All tests and inspections must be documented and available for review by the QAR. [Ref. 16]

DFSC's and DCMC's primary quality assurance guidance is provided in a military standardization handbook, "Quality Surveillance Handbook for Fuels, Lubricants, and Related Products," (MIL-HDBK-200G). [Ref. 10] This handbook provides general instructions and minimum procedures to be utilized worldwide by the military services and DLA in quality surveillance. Part of DFSC-Q's oversight is in "bulk transportation," which MIL-HDBK-200G defines as the transport of petroleum products by tankers, fleet oilers, and barges.

B. REQUIREMENTS FOR MARINE SHIPMENTS

DFSC Operations and Inventory branch (DFSC-OII) furnishes advance information to DCMC offices of impending liftings of petroleum products in tankers chartered by MSC. The notifications contain essential information such as arrival/sail dates, product type and quantity, and destination. Local MSC representatives maintain close liaison with petroleum QAR's to ascertain that the loading or discharge orders held by each are in

agreement, and that the QAR is advised of the estimated time of arrival (ETA), and any schedule changes. The MSC representatives also verify with the QAR that terminal/ refinery operations are ready for the tanker's arrival. [Ref. 5:p. C-2-23]

Prior to a tanker's arrival significant preparations are required. [Ref. 5:p. C-2-22] Masters are responsible for inspection and testing of tank atmospheres prior to loading and for determining suitability for loading the intended cargo. Entries are required in the deck log book that tanks have been inspected and found gas free safe for men. Additionally, records documenting the inspection and condition for each tank are to be completed and made available to the QAR. Of note, the QAR's inspection does not relieve the vessel's personnel of their obligation to inspect the vessel [Ref. 5:p. C-2-23].

Since marine petroleum products under government contracts are FOB origin[6], there are mandatory loading inspection requirements imposed by DLA on the DCMCs. Consequently, QARs perform the following general mandatory inspections [Refs. 18 and 19]

1. **Vessel loading:**

    a. Enter and inspect tanker cargo compartments for suitability to load. Deck inspections are authorized for barges and tankers when a gas-free waiver has been granted by the DFSC-Q Directorate. (The issue of gas-free waivers will be dealt with in the following chapter.)

    b. Validate the vessel and shore cargo operations time statements. (The purpose of this is to ensure vessel and

[6] F.O.B. technically means "Free On Board." But, the terms go far beyond this concept and establish the contractual arrangement where the title and control of goods pass to the buyer, in this case, the government. Thus, "FOB origin" in this context means the government assumes responsibility for the petroleum product after onload. [Ref. 17]

refinery times of "readiness to load" are in agreement in order to prevent false charges for delay by the government [Ref. 19]).

c. Release the vessel when all contractual and QAR mandatory inspection requirements are completed.

2. **Fuel Quality:**

a. Witness sampling of fuel after vessel loading.

b. Validate fuel loaded on the vessel meets contractual quality requirements prior to release of vessel.

3. **Fuel Quantity:**

a. Witness all shore manual gauging when required in the contract.

b. Validate the vessel and shore quantities are within accepted tolerances.

Some aspects of vessel loading and fuel quality requirements warrant further explanation in order to explain the audit trail of quality checks designed to pinpoint any source of *contamination*. These aspects will be discussed in the following subsections.

1. Tank Inspections: Loading

Concerning tanker cargo compartment inspections, MIL-HDBK-200G states:

> An inspector will personally inspect the vessel's tanks and pipeline system prior to loading to determine their suitability for loading. In cases where cargo tanks have been partially filled at a previous loading point and are topped off, the product previously loaded will be ullaged, sampled, and tested to the extent deemed necessary for conformance to the applicable specification prior to topping off. Other cargo tanks which have been loaded at a previous port should be ullaged and sampled, and samples held for test in the event loading difficulties result in commingling of products.

Following certification by a Marine Chemist, QARs enter empty tanks and inspect for water, residual product, rust, blisters and, of course, foreign materials. On a typical tanker such as the SEALIFT CHINA

SEA, where the QARs see the tanker frequently, they already have a fair amount of "corporate knowledge" of the tanks' condition and the crew's thoroughness in tank washing. On the other hand, with a vessel on a spot charter, this is not the case, and the QAR will examine tank conditions much more carefully [Ref. 19]. Unsatisfactory conditions QARs will look for are standing water puddles (there is almost always condensation on tank walls, which is not of concern to QARs), residual product film or puddles, and rust or blisters in the tank coating larger than "hand size" [Ref. 19].

DFSC-Q's greatest concern is the effects of these conditions on product quality and subsequent engine performance and wear. Cleanliness requirements for turbine engines are much more restrictive than those for piston engines. High pressure complex metering equipment built to close tolerances provides precise fuel metering with high consumption rates over wide ranges of altitude, speed, temperature and power [Ref. 10:p. 49]. Therefore, any effects from water or dirt are amplified and accelerated. Some of the more serious effects water can have on gas turbines are flameouts, icing of the fuel system and, if it is saltwater, corrosion of fuel system components. The separation of contaminants from fuel, particularly in the case of JP-5, is complicated by JP-5's higher viscosity and specific gravity qualities.

Residues remaining from improperly cleaned tanks can contaminate the new cargo. Table I of Reference 9 lists critical contamination factors and possibilities (See Appendix B). Some of the deleterious effects impact color, flashpoint, and water-separating ability of the onloaded product.

The beginnings of tank coating failures can be manifested in a number of ways, such as blistering, flaking, rusting, cracking, and discoloration. Rust, which generally comprises 70 to 90% of the total sediment, can cause sticking, sluggishness and general malfunctions of fuel controls, flow dividers, pumps, etc. [Ref. 10:p. 126]. Of note is the "Tank Internal Rust Test" cited in MIL-HDBK-200G (para. 7.1.2.3). This paragraph states, "when considered necessary and where safety precautions permit, ... samples of the rust [will] be taken from selected cargo tanks and tested with the product to be loaded or with similar solvent, to determine the effect upon the corrosiveness and gum characteristics of the product." The rust after being pulverized and mixed with the fuel or solvent is then tested in solution for color, corrosion, and residue. QARs generally feel the presence of rust flakes bigger than palm size in a tank marks the threshold for further examination through testing [Ref. 19]. Blisters of large size should be examined to see if they are carrying pervious cargoes and, if they are, the risk of contamination can become a serious issue [Ref. 20:p. 38].

Another major consideration associated with tank inspections is the review of loading plans where the interface of bulkheads and valve alignment could adversely affect product integrity. For example, in the case of split cargoes, the QAR must insure that bulkheads are secure and that the tanker has at least double valve segregation or line blanks installed. [Ref. 5:p. 6-3] Additionally, serialized valve tag seals must be installed on sea water and/or product valves, and the numbers must be recorded by the QAR and then forwarded to the offload QAR. This step insures that any subsequent incorrect change of valve alignment by the

crew will not compromise or result in loss of the product. [Ref. 5:p. 6-4]

Once the QAR is satisfied the cargo tanks are suitable to receive the intended product, the QAR okays the tanks for loading. If the vessel's tank(s) are determined to be unsuitable for loading, the ship must perform further cleaning as required. If this is required, the cognizant Sealift Operational Task Group Commander must be immediately notified. Additionally, the Master must submit a letter report detailing causes, previous cargoes, types of cleaning performed, and actions recommended to avoid in the future. [Ref. 5:p. C-2-24]

2. Fuel Quality

In order to ascertain product quality, MIL-HDBK-200G defines minimum sampling and testing requirements for petroleum products in Table III (See Appendix G). The type of test required for fuels is coded alpha-numerically and is decoded in Tables IV-A to IV-E. See Appendices H-K (Tables IV-F to IV-L list tests for lubricants and related products.) Table III, Appendix G covers the entire spectrum of bulk transportation: prior to issue, during loading, after loading, prior to discharge, during discharge, and after receipt. Of all the tests required, only type "B-1" and "C" are necessary for bulk transport of fuel shipments. A type "B-1" test is a "partial analysis comprising the checking of principal characteristics most likely to have been affected in the course of moving a product." (See Appendices H-K) A type "C-1" test comprises "specific gravity, color, and appearance, including visible sediment and water tests." The tests for jet fuels in particular have quite a scope. Jet fuels receive an extensive battery of 16 tests under the "B-1" code as

compared to diesel fuels which receive less than half that number of tests under the "B-1" code.

MIL-HDBK-200G [Ref. 8] addresses the cleanliness issue in Chapter 3, "Deterioration Limits of Products." On the filtration time test, which is one of those conducted on aircraft turbine fuels before and after loading in a tanker [Ref. 8:p. 80, 89], MIL-HDBK-200G states,

> Control of this property is essential to prevent rapid buildup in filtration equipment and possible migration of finely divided solids into aircraft. Degradation of filterability may occur in transportation and storage systems and is particularly prevalent when fuel is exposed to saltwater and metallic contaminants. [Ref. 8:p. 17]

Furthermore, on the aspect of water and sediment, MIL-HDBK-200G states,

> These characteristics must be controlled within the transportation, storage, handling and servicing systems in order to avoid serious problems in the operation of aircraft... [Ref. 8:p. 17]

3. Loading Procedures

Initially, approximately 2,000 to 5,000 barrels (bbls.) of product are pumped into one cargo tank, thereby removing any water or contaminant that might have been in the pipeline. The ship will then switch from this trial cargo tank to other tanks and continue loading. Samples are taken and these comprise the "first-ins." QARs observe tests upon "first-ins" that are performed by refinery lab personnel. If this battery of tests reveal contamination then the loading operation is halted until the cause and extent can be determined. [Ref. 4:p. C-2-25 and Ref. 19] The potential exists for offload if the "first-ins" are grossly unsatisfactory. [Ref. 19]

Once loading is complete, the cargo tanks will be gauged, checked for water[7], and temperatures taken. Also, the vessel supplier will sample cargo tanks at this time and test to assure cargo quality prior to release. [Ref. 4:p. C-2-25] These samples are mixed and called the "composite." The composite is considered representative of the entire load. [Ref. 19]

4. Tank Inspections: Offloading

Upon completion of discharge, the receiving activity's QAR will inspect and certify that cargo tanks are dry after a tank washing cycle by signing the Dry Tank Certification form. If the tankers are utilizing the inert gas system (IGS), a statement from Reference 5 must be included that essentially states that the tanks could not be visually examined to ascertain dry conditions, and that the tanks were checked with rods and the draft was recorded [Ref. 5:p. C-2-24]. *This method of checking* prevents the loss of an inert[8] atmosphere and subsequent time that would be needed to reinert the tank.

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[7]The presence of water is determined by performing a color-metric test using water indicating paste (WIP). Paste is rubbed on an ullaging rod and inserted through ullaging ports to determine the petroleum/water interface if any.

[8]Inerting is a process of introducing into a cargo tank a gas or mixture of gases incapable of supporting combustion, such as Nitrogen and Carbon Dioxide. These gases must contain less than 11% oxygen. The purpose of inerting, therefore, is to prevent static electricity formation. Generation of static electricity can be formed by the interface of dissimilar materials, such as the fall of petroleum in a metal cargo tank during loading. [Ref. 1:pp. xxvi, F1]

C. CONCLUSION

DFSC has an enormous task in managing DoD fuel needs. Due to the criticality of the reliable performance in end users, such as aircraft, ships, and vehicles, extremely stringent inspection requirements have been established to identify a source of contamination during transport of newly refined bulk shipments. These sources might be the refinery storage tank, pipelines and transfer manifolds, or the vessel's cargo tanks. Therefore, the inspection requirements focus on four points of product movement:

1. QARs' product quality audits during refining and storage.
2. B-1/C-1 Test batteries on "first-ins" samples.
3. B-1/C-1 Test batteries on "composite" samples after onload.
4. B-1/C-1 Test batteries on "composite" samples at offload.

Based on the premise that *DLA onloads* are FOB origin, these checkpoints will most likely pinpoint the source of contamination. Furthermore, the sensitive nature of some of the products carried in MSC tankers, such as JP-5 demand such attention.

IV. GAS-FREE WAIVER REQUESTS

A. BACKGROUND

The MSC Tanker Division (N3T) periodically submits Gas-Free Waiver Requests to the DFSC Directorate of Quality Assurance and Technical Services (DFSC-Q). The waivers are requested when there is a short transit time, less than 3 days, between the last discharge port and the next loading port. Three days is important because this is the average time required for a T-5 or Sealift Class tanker to complete a full tank cleaning cycle. (Actually, the T-5s can complete tank cleaning faster than Sealifts due to the size and equipment capabilities [Ref. 4]). A full tank cleaning cycle involves activities such as ballasting, machine washing, stripping, gas-freeing, and manual mop-ups. All of these operations take time, cost money and demand an efficient crew. Gas-free Waiver Requests fall into two categories:

1. Requests to load the same product previously carried.
2. Requests to load a product of a lower grade (Example: F-76 following JP-5).

The purpose of these requests is to avoid the costs of having to clean and gas-free tanks for subsequent entry and inspection by a QAR, which is a requirement for FOB origin lifts of DLA petroleum cargo. The costs associated with tank cleaning are delineated in the request and are viewed as the products carried in MSC tankers, such as JP-5 demand such attention. "Cost of Quality" [Ref. 21]. A memorandum sent from DFSC-Q to the MSC Tanker Division in August of 1992 [Ref. 21] requested a detailed

breakdown of costs in an attempt to achieve "an improved process for evaluating tank cleaning/gas-free waiver requests." The Gas-Free Waiver Requests (Appendix L shows a typical Gas-Free Waiver Request) now explain the schedule of a tanker, previous and succeeding cargo types and amounts, and *specific* savings to the government that might possibly be realized if the waiver is granted. These costs can range from $30,000 to $90,000. Table 2 displays the full operating costs (FOS) as of 27 February 1992 for T-5 and Sealift Classes. [Ref. 22]

TABLE 2. FULL OPERATING COSTS PER DAY FOR T-5 AND SEALIFT CLASSES

	FOS COST/DAY	
CATEGORIES	T-5	SEALIFT
CAPITAL HIRE	$13,446	$6,268
OPERATIONAL HIRE	$12,071	$10,671
FUEL (CRUISE SPEED)	$2,515(16K)	$6,302(15.2K)
FUEL (ECON. SPEED)	$1,393(13.5K)	$3,648(11K)
PORT (IDLE)	$1,019	N.A.[9]
PORT (PUMPING)	$2,938	$1,061

The following are definitions of the possible "Cost of Quality" factors present in a Gas-Free Waiver Request [Ref. 4]:

<u>Capital Hire</u>: The daily amount MSC pays towards the mortgage of the vessel.

[9]Not Applicable (N.A.) because Sealift Class tankers are operated under a bareboat charter and thus MSC pays all inport idle costs. (Chapter II explained the different types of charter in MSC tanker operations).

Operational Hire:	The daily amount the tanker operating company charges MSC for the services of the tanker crew.
Extra Transit Time:	The sum of the Capital and Operational Hire costs times the number of extra days.
Fuel Expended:	The amount of propulsion fuel oil consumed during tank cleaning times the price/ gallon.
Lube Expended:	The amount of propulsion lubricating oil consumed during tank cleaning times the price/gallon.
Fuel for Inerting Tanks:	The cost of the amount of fuel that must be expended in order to provide an inert atmosphere in the tanks.
Disposal of Slops:	The expected cost of disposing of waste at a particular port.

B. DEFENSE FUEL SUPPLY CENTER EVALUATION

When DFSC-Q receives a Gas-Free Waiver Request from the MSC Tanker Division, DFSC-Q evaluates whether to grant a waiver based on the above costs and the following factors, which are detailed below. [Ref. 23]

1. Previous and succeeding cargoes.
2. Type of charter.
3. Maintenance phase of the tanker.
4. Product Origin.
5. Liability.
6. Cascading effects of an off-specification load.

1. Previous and Succeeding Cargoes

As explained in Chapter II, Section B, "Cargo Tank Cleaning Requirements," small amounts of an incompatible product can contaminate

follow-on cargoes. DFSC-Q will assess the chemical characteristics and incompatibilities delineated in Reference 10.

Unfortunately, salt water ballast loaded into cargo tanks for safety reasons during rough transits (and later discharged as dirty ballast at sea or to an authorized recycling facility inport) can also be considered a "cargo." DFSC does not have control over this and the potential for salt water ballast to enter into the continuum of product carriage concerns DFSC-Q and causes hesitation on their part to grant a waiver. This is the primary reason that they insist upon inspecting cargo tanks.

2. Type of Charter

As explained in Chapter II, MSC charters ships under three types of contracts: bareboat, time, and spot. In FY 1992, bareboat and time charters handled 87% of the petroleum long ton-miles transported, while spot charters handled only 13% [Ref. 6:p. A-7]. Therefore, with a bareboat or time charter, QARs frequently see the same tankers as the tankers transport products across different DFRs. A tanker will develop a reputation as a function of the operating company, crew proficiency, and material condition. Consequently, DFSC-Q may be more likely to grant a waiver if the reputation is favorable. On the other hand, with a spot charter, all the previous factors are unknowns. DFSC-Q will not grant a waiver to gas-free cargo tanks and subsequently forego an internal inspection.

3. Maintenance Phase of the Tanker

If a tanker has just completed a maintenance period where work was performed in cargo tanks, then DFSC-Q treats this situation the same

as a spot charter. DFSC-Q would deny a waiver request, and insist upon an inspection by a QAR.

4. Product Origin

When evaluating gas-free waiver requests, DFSC closely scrutinizes where the product originated from. Petroleum products transported in MSC tankers of the T-5 and Sealift Class are predominately aviation and marine distillates. These tankers will load these refined products from two places: DFSPs and commercial refineries. If the product is stored at a DFSP, then that product, refined commercially and transported by either government or commercial means, has already passed QA checks and is government-owned. Conversely, when a MSC tanker loads a product at a commercial refinery, the product is most likely newly refined. Thus, the FOB origin issue arises, and ownership of the load will *transfer to the government only after the appropriate tests are* conducted by company testers and observed by the QAR. In addition, QAR tank inspections are required before filling.

Consequently, DFSC-Q will be more likely to grant a waiver when the product is being moved from a DFSP because, if there is a problem with specifications, it is essentially only an "in-house" investigation; that is, an intra-governmental problem. In this case, a formal government investigation would be convened to pinpoint the cause and any culpability. DFSC would not have to argue with a commercial company, and possibly resort to litigation to prove culpability, and ultimately offload that fuel.

On the other hand, if the product originates at a commercial refinery, then the Gas-Free Waiver Requests are closely scrutinized.

Refineries also develop reputations for quality control. And, as stated in the preceding paragraph, the issue of who (the government or the refinery) will assume responsibility for a load of off-specification fuel is significantly more complicated.

5. Liability

DFSC-Q believes sufficient liability is not present in MSC charter contracts with its operators and that MSC may not pursue recovery from an operator responsible for negligently contaminating a cargo. Therefore, DFSC-Q is always hesitant to grant a gas-free waiver because of this aspect.

6. Cascading Effects of an Off-Specification Load

When viewing the issue of how DFSC handles off-specification fuel, a comparison between the government and the commercial world lends perspective to DFSC's reluctance to grant Gas-Free Waivers. Take, for example, a load of JP-5 that is determined to be sufficiently off-specification such that it cannot be used for aircraft. DFSC has significantly less sales options than a commercial refinery, and suffers from cascading effects from managing the future of that load. Also, DFSC's customer base is much more limited and quality-conscious than that of an average commercial refinery. Therefore, when handling the disposition of a load of off-specification JP-5, DFSC will look at reclamation[10] or down-grading[11]. DFSC will work with the appropriate

[10] Reclamation is the procedure that will restore or change the quality of a contaminated or off-specification product so it will meet the specifications of the original or a lower grade [Ref. 10:p. 11].

service branch to find the best use [Ref. 23]. But, before that can be done, DFSC may have a storage problem. Ullage is extremely tight at most DoD activities. If an activity was expecting JP-5, putting an off-specification or contaminated product creates the same tank cleaning problems ashore as that on tankers. Particular attention must be paid to preceding and succeeding cargoes in shoreside DFSP tanks for the same reasons as those on tankers. Additionally, if this load sits in a tanker instead of a shoreside storage tank, demurrage costs[12] and opportunity costs accrue. Furthermore, that load of JP-5 was destined for a particular DFR and activity. The original need for the fuel must still be met whether it is approved for use with qualifications or a whole new load is procured and transported. Therefore, the negative cascading and costly effects of investigating, deciding, storing, refining, and transporting an off-specification load is *perhaps* the singularly most important aspect DFSC-Q considers in assessing Gas-Free Waiver Requests. Essentially, it is a decision of saving thousands of dollars in not cleaning tanks weighed against potentially incurring follow-on costs that might possibly range in the millions if the product is found off-specification. [Ref. 23]

Appendices M and N display typical DFSC-Q responses to Gas-Free Waiver Requests from the MSC Tanker Division. Justification and further instructions are included as appropriate. Worthy of note is the caveat

[11]Downgrading is the procedures by which an off-specification or contaminated product is approved for use as a lower grade of the same or similar product [Ref. 10:p. 9].

[12]Demurrage charges are those incurred by the shipper, MSC in this case, for detention of a shipment beyond its specified contract time. The basis for this charge is to recoup a "rental fee" for using the tanker as free storage. [Ref. 17:p. 68]

included in the Appendix N, the granted Gas-Free Waiver Request. Paragraph 3 says "Final determination to Load rests with the loading Quality Surveillance Representative based upon their cargo tank inspection from the deck." When deck inspections are performed, the QAR uses mirrors to reflect sunlight, if present, or explosion-proof flashlights to observe tank low spots through the ullage ports [Ref. 19]. Usually at the time of inspection the tanker is already trimmed with the stern down because it facilitates mop-up operations by the crew in the tank prior to entering port. Therefore, any puddles of water or residue present are easily visible from the ullage ports [Ref. 19].

C. CONCLUSION

It appears DFSC-Q denies Gas-Free Waiver Requests and insists upon tank inspections (which requires washing tanks) for three primary reasons. First, they are mandated by DLA, as stated above. Secondly, the tankers are showing age and wear as exhibited by pervasive rust and peeling of tank coatings. (The author observed at least two different color coatings in various states of peeling onboard the SEALIFT CHINA SEA. Also, this vessel is representative of most the Sealift Class's condition [Ref. 19]). Finally, DFSC-Q does not have control over what can enter cargo tanks on ballast voyages. For instance, even thought the T-5s and Sealifts are fitted with SBTs, operators will still put salt water ballast in cargo tanks when weather conditions necessitate. Consequently, DFSC-Q insists upon internal tank inspections for these reasons and will only consider granting a Gas-Free Waiver Request from MSC when, in rare instances, the

"Cost of Quality" factors cited in Chapter III actually outweigh all other factors.

While DFSC-Q's concerns are valid, there appears to be a sufficient system of quality checks and balances that should achieve desired goals. This system is comprised of the IQUE (In-plant quality evaluation) program, the QAR's corporate knowledge, the "First-in," and "Composite" samples. Lastly, the P&I clause in MSC contracts and latent defects in bulk fuel contracts should ensure responsibility on the tanker operator and refinery's parts, respectively.

As stated in Chapter III, the IQUE program's primary objective is to ensure acceptance of conforming products. One of the IQUE's main principles is product audits on a continuing basis to determine that the refinery is adequately detecting defects in the processes that span from refining to delivery into a cargo tanker.

Secondly, since T-5s and Sealifts are operated under a time and bareboat charter, respectively, they sail on mostly regular schedules. Thus, QARs consistently see these tankers and crews. Most of the time a QAR can predict what the conditions will be like in a particular ship's cargo tank. Essentially, then the QAR's internal inspection serves only as a verification of the crew's thoroughness in complying to instructions set forth in MIL-HDBK-291(SH), Figure 25 "Cargo Tank Cleaning Requirements." MSC instructions and contracts [Refs. 5 and 15] with its operators should sufficiently protect the government's interests in assuring a crew's compliance with quality and environmental directives.

On the issue of samples, the "First-ins" and Composites, these should immediately reveal any discrepancies. If the "First-ins" are

unsatisfactory, the QAR has the authority to halt onload until the discrepancies are resolved. Even if an offload must then be conducted, it is only around 3,000 to 4,000 bbls.

But, despite the care in ensuring a tanker is clean and dry, and the overlapping system of quality checks and balances, it is hard to imagine that the conditions onboard tankers as described above are not, in the long run, resulting in the delivery of less than perfect fuels to end users, particularly given the sensitive nature of aviation fuels. Chapter III and this chapter (and associated Appendices) should have given the reader an appreciation for the necessity to maintain strict quality standards, how product degradation is detected, and the consequential negative effects of handling the disposition of off-specification products. Why then, with such stringent requirements, are clean products being transported in tankers that appear to be in less than optimal condition?

Perhaps contamination from rust and tank coating sediment becomes untraceable because of the ultimate parcelling of loads from tankers offloading into DFSPs, consolidating with other tankers, ships, etc. But, until a major incident occurs that can be traced to a particular batch of fuel, this may remain unnoticed in the quality assurance continuum.

Is it also possible that repeated tank washings at 135 degrees F. and 100 psi are ***actually contributing to the deterioration*** of the cargo tanks' condition by progressively removing tank coatings and promoting rust? This might be the case. The essential benefit of tank washings is to remove the lingering effects of previous products. But, when previous and successive products are the ***same or compatible***, and the tanks' coatings

are already "scarred," washing tanks just may create more sediment and rust by loosening peeling coating. Thus, a vicious circle develops. Therefore, the practice of washing tanks for QAR inspections for same product or lower grade loads (given compatible flashpoint) only seems to create an unnecessary amount of slops.

V. COMMERCIAL PRACTICES

A. INTRODUCTION

This chapter will examine the commercial oil tanker business and tank cleaning practices. The nature of commercial clean product tanker operations resembles the operations of tankers in government service. Both operations have similar tank cleaning requirements, are extremely quality and environmentally conscious, and face like obstacles in waste disposal. However, commercial oil companies' economic incentives are distinctly different from the government's. Guided by the Defense Business Operating Fund, the government's goal in tanker operations is to ultimately break even within a nonappropriated fund. On the other hand, commercial companies are driven by the necessity to fulfill shareholders' expectations *now*, which is an extremely difficult task. The characteristics and history of the economic environment commercial oil companies face is worth visiting, and will place in perspective the difficult nature of the commercial tanker business.

1. Influences

Since seaborne trade is one of the world's most global industries, it is subject to the vagaries of many global events and trends. Furthermore, because it is such an international business with important economic impacts, it is also a target for tremendous national and international political intervention [Ref. 24:p. 6]. Intervention germane to tankers are safety at sea issues and environmental protection

initiatives. An example of a radical environmental argument, heard in the 1970s, was the one to retrofit all tankers with segregated ballast tanks (SBT), rather than mandate a requirement to have newly constructed tankers launched with an SBT system already incorporated from the design phase [Ref. 24:p. 83]. Designed to eliminate the creation of dirty ballast and thus lessen oil discharges by tankers, SBTs reduce cargo space. It appears one of the winning arguments that defeated this initiative was experts' estimates that transport capacity of the world's fleets would have been reduced by 20 percent. Lastly and most importantly, the shipping market is highly volatile as a result of excessive swings in supply, demand and unpredictable geo-political events [Ref. 24:p. 50]. For instance, one of the events that had a tremendous impact was the 1973 Yom Kippur War which closed the Suez Canal, a major route for tankers carrying Arab crude to European refineries. Consequently, tankers had to sail around Cape Horn in South Africa which significantly extended voyages and raised the cost of transport.

The most notorious characteristic of the shipping market is its succession of alternating peaks and valleys known as shipping market cycles [Ref. 24:p. 52]. Essentially, these extremes stem from a rise in freight rates in concert with a rise in demand. However, as latecomers, who tend to link their ordering behavior to the *current* state of the market, add new ships to the supply, freight rates decline. Consequently, the market becomes depressed, sometimes for as long as ten years, but with an average of three to four years from trough to trough. [Ref. 24:p. 52]

The tanker market has experienced the full effect of the peaks and valleys of the shipping market cycle since it is totally dependent on

the economics of the oil industry. Following World War II oil was cheap to produce and its price fell in real terms from a 1950 cost of $4.00/bbl to a 1970 price of $1.60/bbl [Ref. 24:p. 221]. Meanwhile, shipowners were capitalizing on the advantage of economies of scale by building larger ships to move petroleum. But the oil crisis of 1973 halted the period of astonishing growth in the industry and tanker size. Adding further to the problems was the fact that the price of oil rose dramatically in 1973 to $9.00 from the 1970 low of $1.60. Oil continued to rise in price to a high of $30.00/bbl in 1980. But economic recessions and drops in consumption in the three regions that were the largest consumers of oil, United States, Western Europe and Japan, precipitated a decrease in demand for oil and tankers. [Ref. 24:p. 222] This depression in the tanker market is one of those that has lasted longer than the average, ten years in this case. Since 1980 the price of oil has slowly declined and is presently around $10.00/bbl.

The political dimension plays a crucial role in seaborne oil trade with three power groups comprising the power players [Ref. 24:p. 223]. First, are the world's seven major oil companies, who operate, mostly through long term charters, more than half of the tonnage of seaborne oil transports [Ref. 24:p. 225] The second group is the Organization of Petroleum Exporting Countries (OPEC), which represents the majority of oil exporters.[13] The last group is the governments of the oil-importing countries, who represent consumers and control policy with

[13]OPEC's leverage on the world trade has diminished since its peak in the earlv 1970's largely due to the rise of output by new exporters such as Venezuela, Thailand, and Malaysia, and its own inability to agree on production limits.

respect to strategic oil stocks and energy-conserving programs [Ref. 24:p. 225].

The dilemma facing tanker operators is best captured by Stopford in Reference 24 who cites a 1985 quote from Fearnleys, a dominant shipbroker:

> The last ten years of capital drain in the tanker industry have no historical precedent and we have witnessed a decimation of shipping companies which has no parallel in modern economic history.... The surviving members of the independent tanker fleets must be akin to those of the world's endangered species whose survival appeared questionable... but have instead shown a remarkable ability to adapt.

2. Tanker Costs

The next aspect of the tanker business which needs to be considered is managing cash flow. This aspect is necessary for survival of a tanker shipping company. Cash flow represents the difference between cash payments and cash receipts in an accounting period, and is not necessarily associated with profit because of the accounting mismatch in income received and costs incurred. Cash flow can fund expansion by giving ship owners the means to purchase new ships, but it can also spell doom by forcing scrapping decisions. [Ref. 24:p. 97]

Three variables determine cash flow [Ref. 24:p. 97]:

1. The revenue received from chartering/operating the ship.
2. The costs of financing the ship.
3. The cash cost of running the ship.

Revenue received from chartering/operating the ship depends on cargo capacity, ship productivity, and freight rates. Critical to achieving desired revenue goals for tankers is effective management that minimizes time in ballast and keeps tankers at sea [Ref. 25]. Financing

the ship is dependent upon capital repayment and interest dimensions. [Ref. 24:p. 99].

Central to this thesis are the cash costs of running a tanker. This is where the issues of tank cleaning and waste disposal are most visible for a commercial company. Three categories capture these costs: operating, voyage, and cargo handling costs.

Operating costs are those incurred in the daily running of the ship and can be described by the following equation [Ref. 24:p. 103]:

$$OC = M + ST + MN + I + AD,$$

where: M = *manning;*

ST = *stores;*

MN = *repairs & maintenance;*

I = *insurance; and*

AD = *administration.*

The costs most pertinent to tank cleaning are crew costs (M), stores (ST) and insurance (I). Crew costs (M) can comprise up to 50% of the total operating cost equation. Crew costs consist of salaries, wages and overtime [Ref. 24:p. 103]. Time spent cleaning, stripping, mopping, and wiping tanks can rapidly eat away an overtime budget.

A vital stores cost (ST) is lubricating oil since most tankers are diesel powered and therefore can consume large quantities of lubricating oil depending upon voyage length and/or high speeds [Ref. 24:p. 105]. Extra time at sea completing tank cleaning cycles can be quantified in the cost of lube oil consumed [Ref. 4]. Lastly, insurance costs (I) are absolutely unavoidable for an operator. Two types of

insurance comprise the majority of insurance costs: Hull and Machinery (H&M) and Protection and Indemnity (P&I). H&M protects the owner against physical loss or damage to the vessel, while P&I covers against third party claims for damage to cargo, collision and pollution. Premium levels are based upon the shipowner's claim record, trading area, flag of registry, and nationality of the crew [Ref. 24:p. 106].

Voyage costs are considered variable costs because they are a function of a particular voyage [Ref. 24:p. 107]:

$$VC = FC + PD + TP + CD,$$

where: *VC = voyage costs;*

FC = fuel costs for main engines and auxiliaries;

PD = port and light dues, etc.;

TP = tugs and pilotage, etc.; and

CD = canal dues.

Due to the rise in the price of oil, fuel costs (FC) have become the single most important item in the voyage cost equation. This has precipitated major improvements in the designs of main engines and auxiliaries, and attention to hull smoothness [Ref. 24:pp. 109-110]. Again, time spent at sea cleaning tanks consumes fuel and adds further to the voyage costs. The other component of the voyage cost equation relevant to this thesis is port charges (PD), which are a wide range of fees levied against a vessel and/or cargo for the use of facilities and services provided by the port. Of interest here is the cost of slops disposal, which will be discussed at length in the next chapter. Slops disposal costs are quite expensive and rising [Refs. 4, and 25].

The last type of cost is cargo handling. It is described by the following equation [Ref. 24:p. 113]:

$$CHC = L + DIS + CL,$$

where: CHC = *cargo handling costs;*

L = *cargo loading costs;*

DIS = *cargo discharging costs; and*

CL = *cargo claims.*

Tankers incur port charges for cargo loading and discharging. Another factor, not shown in the equation, is the cost for the Marine Chemist, when required, to certify that the atmospheres of cargo tanks are safe. Lastly, claims (CL) as a consequence of product contamination or degradation could be a large component if the tanker was proven at fault.

In order to optimize cash flow, tanker operators seek to maximize the productivity of a vessel. A look at the variables that determine productivity will reveal the impact of tank cleaning and the associated issues of cost, time, disposal, etc., on productivity.

Productivity of a fleet can be determined by dividing the total ton-miles[14] of cargo shipments in the year by the deadweight tonnage[15] fleet actively employed in carrying the cargo [Ref. 24:p. 81].

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[14]A ton-mile is the movement of one ton of freight a distance of one mile which is computed by multiplying the weight in tons of each shipment transported by the distance hauled. [Ref. 17:p. 226]

[15]Deadweight tonnage is the number of tons (2,240 pounds) a vessel can transport of cargo, stores, and bunker fuel. It is equal to the difference between the number of tons of water a vessel displaces when empty and the tons displaced when submerged to the load line. [Ref. 17:p. 66]

Productivity depends on three factors [Ref. 24:p. 81] mean operating speed, deadweight utilization, and loaded days at sea.

Since fuel comprises a major portion of daily costs, finding the optimal operating speed is vital. Operators select a speed for tankers that gives the best financial performance for a specific level of freight rates, bunker costs, and performance parameters. [Ref. 24:p. 81] Maximizing deadweight utilization is also extremely important. Deadweight lost to the space required for bunkers, slops, stores, etc., is space that does not generate revenue.

Lastly, a tanker's time is divided between loaded days at sea and "unproductive days," such as those in ballast, port, or off-hire [Ref. 24:p. 82]. Obviously, a reduction in these latter periods adds to the available loaded days at sea, provided there is sufficient demand for the ship's services.

Thus, when examining the impact of tank cleaning, the opportunity costs quickly accumulate. Extra time at sea cleaning tanks expends precious fuel and lube oil and does not generate revenue. Tank cleanings create slops which must either be carefully discharged at sea, expensively pumped ashore, or unproductively occupy "revenue space." And, of course, manual cleaning after machine cleaning consume labor budgets. Therefore, tanker operators seek to become as efficient as possible when planning and executing these operations. [Refs. 4 and 25] That is why most operators attempt to clean tanks exclusively on ballast voyages[16] [Refs. 4 and 25].

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[16]Ballast voyages are conducted when a tanker is empty of cargo. Consequently, it would ride high in the water. Therefore, ships are ballasted in SBTs and/or cargo tanks based on weather conditions. Ballasting increases seaworthiness and stability, equalized stresses on the hull, and increases maneuverability and speed. [Ref. 12:p. 147]

B. COMMERCIAL TANK CLEANING PRACTICES

1. Chevron Shipping Company Operations

In this analysis Chevron Shipping Company's (CSC) operations will be used as a comparison to government tanker operations for two important reasons. First, Chevron is the world's largest producer of jet fuel [Ref. 25]. Secondly, Chevron's quality concerns parallel those of DFSC. For instance, CSC will consider doing business with just 30 international tanker companies in the entire world when seeking to supplement its own fleet. On the average, only 20 will make the final screening for charter [Ref. 38]. Thus, to become a charter hire for CSC is to become a member of a very exclusive club. Driving this scrutiny are the issues of liability for pollution incidents and preservation of the quality of the products being transported [Ref. 25].

The OPA-90, mentioned in Chapter II, has an ominous aspect. It mandates unlimited liability for pollution damage. Consequently, a financially sound, responsible shipping company could be bankrupted by a single incident [Ref. 12:p. 247 and Ref. 25]. Therefore, the nature of Chevron's carriage and emphasis on total quality and safety in the transportation spectrum makes Chevron an ideal company for comparison to government practices.

CSC operates a fleet of 70 to 90 Chevron-owned tankers supplemented by 30 to 50 spot chartered tankers. All the tankers must have SBTs and IGSs Also, the proportion of double-hulled tankers is increasing [Ref. 25]. In fact, Chevron was one of the first companies to start utilizing double-hulled tankers over 20 years ago [Ref. 25].

2. Quality Assurance

Chevron has the same concerns for quality, efficiency, and environmental sensitivity as the government. But, it has a unique practice (compared to the government) that optimizes quality by having totally clean tanks, yet not incur the excessive costs of slops disposal or increase the risk of environmental accidents. The unique practice Chevron performs (only with Chevron-owned tankers) is clean product flushes at the refinery for tankers that have just carried clean products. Generally, these flushes are performed with clean products such as off-specification diesel, which have properties conducive to follow-on loads of some jet fuel products, such as Jet-A[17]. After washing the tanks with diesel, the diesel is pumped back to the refinery. Because Chevron, USA is paying all the bills for this operation and owns the tankers, Chevron can afford to use this procedure. [Ref. 25]

Refined product flushes have important advantages. The primary advantage is that salt water never enters the tank except in an emergency, such ballasting for heavy weather. Thus, chances of salt water contaminating end users are almost zero. Moreover, slops are not created, and therefore the expensive costs of disposal and risks of pollution from improper decanting over the side by tanker crews are eliminated. And lastly, the necessity to enter the tank at the terminal of onload is unnecessary. In fact, Chevron does not even allow tank entry at its piers

[17]Jet A or Comjet A-1 is a jet fuel not affected by off-specification [Ref. 25] contaminant separation as JP-5. JP-5, which is much more viscous than Jet-A, is more likely to be affected by a previous product's lingering effects, such as color. (See Appendix F and Chapter III).

due to the hazardous nature of the cargo [Ref. 25].[18] Any required gas-freeing and tank inspection must be performed by the crew at sea. Obviously, this practice is inherently safer than the government's. Finally, problems with off-specification fuel are almost nonexistent. [Ref. 25]

For CSC's international fleet, which is voyage-charted, Chevron publishes tank preparation charts [Ref. 25] similar to MIL-HDBK-200G TABLE VI [Ref. 10]. (See Appendix O) But these charts are only ***recommendations*** for vessel operating companies to follow when seeking carriage of products for CSC. Additionally, prior to chartering a vessel, CSC requires a list of the last three products carried to ensure that the vessel's previous cargoes will not contaminate Chevron refined products. If any of the potential charter's last three products were crude or "black products," CSC *is unlikely to employ* that vessel. [Ref. 25]

CSC rarely performs internal tank inspections of voyage charters. Verification of tank conditions are based upon the results of the "first-in" samples. If these are unsatisfactory, the product will be offloaded and an investigation performed. If a product is found to be off-specification after transport in a tanker, CSC will pursue compensation from the vessel's operators in court. [Ref. 25]

For Chevron-owned vessels, CSC is very concerned with tank coating condition. Generally, any aberration, such as coating peeling or

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[18]Shell Refinery in Martinez, California, is one of the few refineries on the U.S. West Coast that still allows QARs to enter and conduct tank inspections at Shell piers. Other refineries will not allow this. Consequently, QARs and Marine Chemists must coordinate inspections with the tanker prior to mooring. [Refs. 16, 19, and 25]

rust, that covers greater than ten percent of any individual tank's surface area is cause for corrective action (or rejection, in the case of voyage charter candidates). CSC is particularly intolerant of rust due to the negative impact of rust on the test of water separating ability, which is an extremely important characteristic for aviation fuels.

The tank cleaning charts CSC publishes are similar in format as those of DLA. But the range of product situations are much broader (many of these products are not of interest to the government). However, in the chart covering Clean to Clean products the actions detailed for tank cleaning are nearly identical to DLA's. For ease of comparison, the same cleaning situations discussed in Chapter II; namely jet to jet, jet to diesel, diesel to jet, and diesel to diesel are summarized in Table 3. The categorizations of these fuels are that "jet" stands for Chevron Jet A-1 and 50 and diesel is defined as just that.

TABLE 3. COMMERCIAL TANK CLEANING SUMMARY

	NEXT PRODUCT	
LAST PRODUCT	**JET**	**DIESEL**
JET	STRIP & DRAIN LOADING, DISCHARGE LINES AND TANKS	SAME AS JET TO JET
DIESEL	HOT WASH TANKS, FLUSH, DRAIN, STRIP AND WIPE TANKS	SAME AS JET TO JET

Note that these procedures are essentially the same as those summarized in Chapter II, Table 1. Tanks are to be washed when going from

diesel to jet and only lines are dropped and tanks stripped in the other three combinations.

C. CONCLUSION

CSC is a very successful company in the tanker business. It successfully meets demand by ensuring total quality and safety in the carriage of all varieties of petroleum products. A quintessential example of the "survivor" company (as described in a quote cited from Fearnleys earlier in this chapter), CSC is an ideal example for assessing practices possibly applicable to the government.

VI. SLOPS DISPOSAL

A. BACKGROUND

The issue of tanker-generated oil pollution has gathered considerable momentum in the public realm, largely through disastrous spills. However, the discharges in these accidents are considerably less than the amount discharged into the world's oceans during routine tanker operations. It is estimated that between 1.0 and 1.5 million tons of oil are being discharged annually into the sea, not as a consequence of spills or collisions, but as a result of routine tank cleaning and ballast operations [Ref. 26:p. 1]. Viewed another way, routine tank cleaning and ballasting are estimated to comprise 14% of the total oil pollution from all land and ocean sources, which includes items such as highway vehicles, industrial machinery, and off-shore production rigs [Ref. 26:p. 10].

1. Pollution Reduction Methods

At this point a distinction must be made between the practices of crude oil and refined product tankers. Crude oil tankers, by virtue of sheer volume transported, can potentially contribute to the environment the majority of oil from tank washings and ballasting operations. However, in recent years operations called Load-on-Top (LOT) and Crude Oil Washing (COW) have been adopted by crude carriers to minimize these discharges.

LOT is dependent upon the gravity settling of oil-water mixtures and the careful handling of separated water and oil during ballast

changing and tankwashing with water [Ref. 27:p. 97]. Figure 7A and 7B provide diagrams of the LOT sequence. Figure 5B shows that in the final stage the new cargo, crude, is loaded "on top" of the oil-water emulsion, which is riding on free water, and thus the entire mixture is discharged as ***part of the cargo at the receiving port.*** Later, in the first step of the refining process, oil is usually stored for a period to allow water in the oil to separate out and then the water is drawn off prior to refining [Ref. 12:p. 28].

The second operation, COW, also attempts to reduce pollution by crude oil tankers. A ship's tanks which have held crude oil usually contain deposits of sediment on the tank bottoms and other horizontal surfaces of the tank's structures. This sediment builds up over time and can impede drainage and eventually reduce cargo-carrying capacity. In the past tanks were washed with jets of water, but this operation produced large amounts of oily water which then had to be separated. Furthermore, this separation was complicated by the oil and water emulsion produced during water washing. [Ref. 28:p. A2]

Therefore, in COW, part of the cargo is circulated during ***discharge*** through fixed tank cleaning equipment to remove stubborn deposits. COW thus has the benefits of avoiding salt water contamination. Moreover, it maximizes carrying capacity since slops is not created, and therefore, not occupying cargo tanks. [Ref. 28:p. A4]

LOT is not conducive to refined product carriage because onloaded refined products cannot be mixed with water/salt/product residues that are indigenous in slops already present. Additionally, sludges usually do not build up from the carriage of clean products. And, "washing" with the

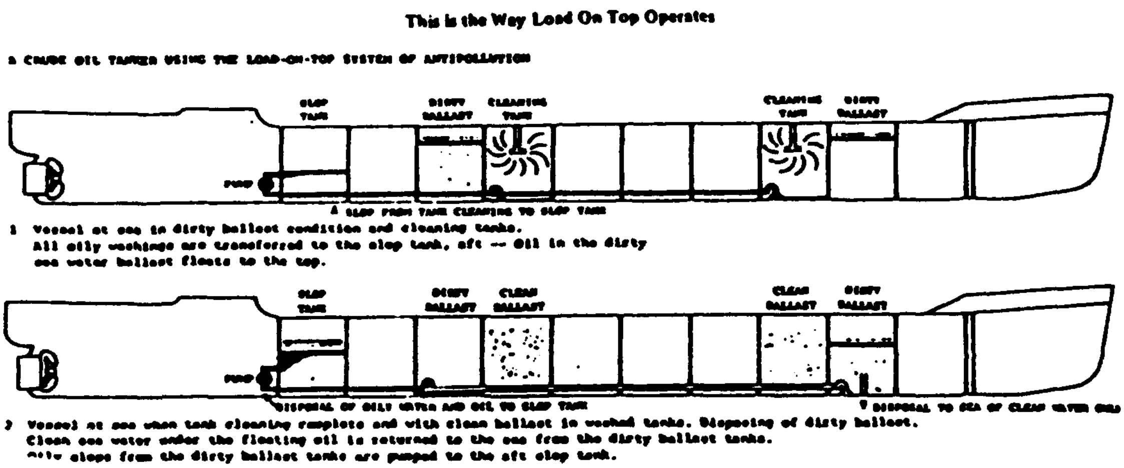

Figure 7A. A Crude Oil Tanker Using the Load-On-Top System of Antipollution [Ref. 26]

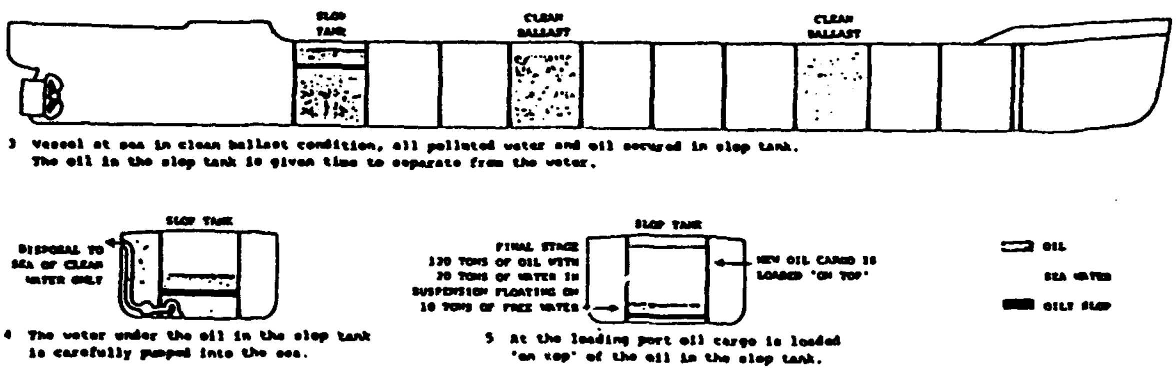

Figure 7B. A Crude Oil Tanker Using the Load-On-Top System of Antipollution (Continued) [Ref. 26]

preceding product still leaves residue ***possibly*** incompatible with the subsequent cargo. Therefore, refined product carriers in government service presently resort to salt water washing. However, careful separation techniques, which will be detailed shortly, are performed on the refined product tankers to minimize the amount of unnecessary slops retained onboard.

2. Slops Handling

In order to reduce oil pollution and minimize slops discharged ashore, which is extremely expensive, Masters of refined product tankers are required to separate and retain all oily waste residue resulting from tank washings and dirty ballast [Ref. 5:p. C-9-3]. The process of separating slops is a difficult task for a tanker crew and involves many factors which will now be discussed.

Slops are collected onboard in a designated slop tank. The slop tank may be a designated cargo tank, or a specially constructed tank or tanks that can receive slops oil, wash water, heavily contaminated dirty ballast water, line flushings and dirty bilge water for further separation of oil and water. [Refs. 5:p. C-9-3 and 27:p. 40] Upon the completion of tank washing or filling the slop tank, the slop tank should be settled for anywhere from 12 [illegible] hours, or even more [Refs. 5:p. C-9-4 and 27:p. 21]. Slops separate as a function of the contents' specific gravities, with water settling below oil. If the tanker is so equipped, the use of heating coils to expedite separation should be employed to expedite the separation of water and oil. Unfortunately, the Sealift and T-5 classes of tankers, which are the focus of this thesis, do not have these heating coils.

The oil floating on top of free water in a slop tank usually contains a certain amount of water in suspension, called an emulsion, which is impossible to separate by technical means onboard the tankers. Although considerable variation exists, suspended water content generally does not exceed 30%, and may be less [Ref. 27:p. 40].

Regardless of whether vessels have an oily water separator (OWS), operators must still be able to ascertain slop tank contents in order not to accidentally discharge oil into the sea (The Sealift and T-5 Classes both have OWSs). But, gauging slops tanks has potential dangers. Specific safety considerations include preventing static discharges, avoiding inhalation of harmful concentrations of toxic gas and insuring release of pressure in slops tank(s) on vessels with inert systems prior to opening the ullage plug(s)[19] [Ref. 27:p. 42].

Inert Gas Systems (IGS) neutralize the threat of explosion in cargo tanks from static electricity created during the fall of petroleum into a cargo tank. Most systems utilize flue gas, which is post-combustion ship's boiler air. Already inert, flue gas is filtered, cooled and piped into cargo tanks until the oxygen in the air falls below 8%. [Ref. 12:p. 186] Ships that are diesel powered utilize carbon dioxide IGSs. The Sealift Class do not have Inert Gas System (IGS) capability.

Once the permission of the Master or responsible officer is obtained to gauge the slops tank, ascertaining the depth of free water below the oily/water interface is performed as follows. Gaugers should

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[19]Ullage plugs are the tank covers on a cargo tank. Ullage is the distance from an above-deck datum (usually at the top of the ullage hole) to the surface of the liquid in the tank. "Ullaging refers to gauging the amount of liquid cargo in a tank. [Ref. 12:pp. 40-42]

measure two points: the ullage of the slop oil and the position of the interface of the slop oil and free water. Oil/water interfaces can be located ideally by the use of a modified ullage tape which works on the principle that salt water conducts electricity. Current is produced electrolytically by the difference in electric potential between a zinc insert in the tape weight and the steel structure of the tank (See Figure 8). Another way to determine the oil/water interface is to use water-indicating paste (WIP) or ribbon. However, the color change point faces the possibility of being obscured or obliterated as the tape is withdrawn through the oil. Operators of the T-5 and Sealift class tankers use the WIP because usually clean products are onboard. Finally, the problem of determining the oil/water interface in slops can be complicated by differences in oil make-up, weather and the physical differences between dissolved oil and free oil in emulsion. [Ref. 26:p. 82]

Once the oil/water interface is identified, the volume of slop oil and free water can be determined in the slop tank using ullage and trim tables. It should be noted that temperature correction factors are not necessary since the volume adjustments are negligible [Ref. 27:p. 41].

After gauging and volume determinations are made, slops are decanted by pumping the seawater overboard with the bottom suction and retaining the oil floating on top. Vessels that have OWSs can come close to eliminating all free water without discharging oil overboard [Ref. 27:p. 41]. Decanting, though approved by regulations, carries with it the risk of violation through accidental contamination of the environment. Tanker operators strive to strictly comply with pollution laws in order to avoid expensive fines and delays.

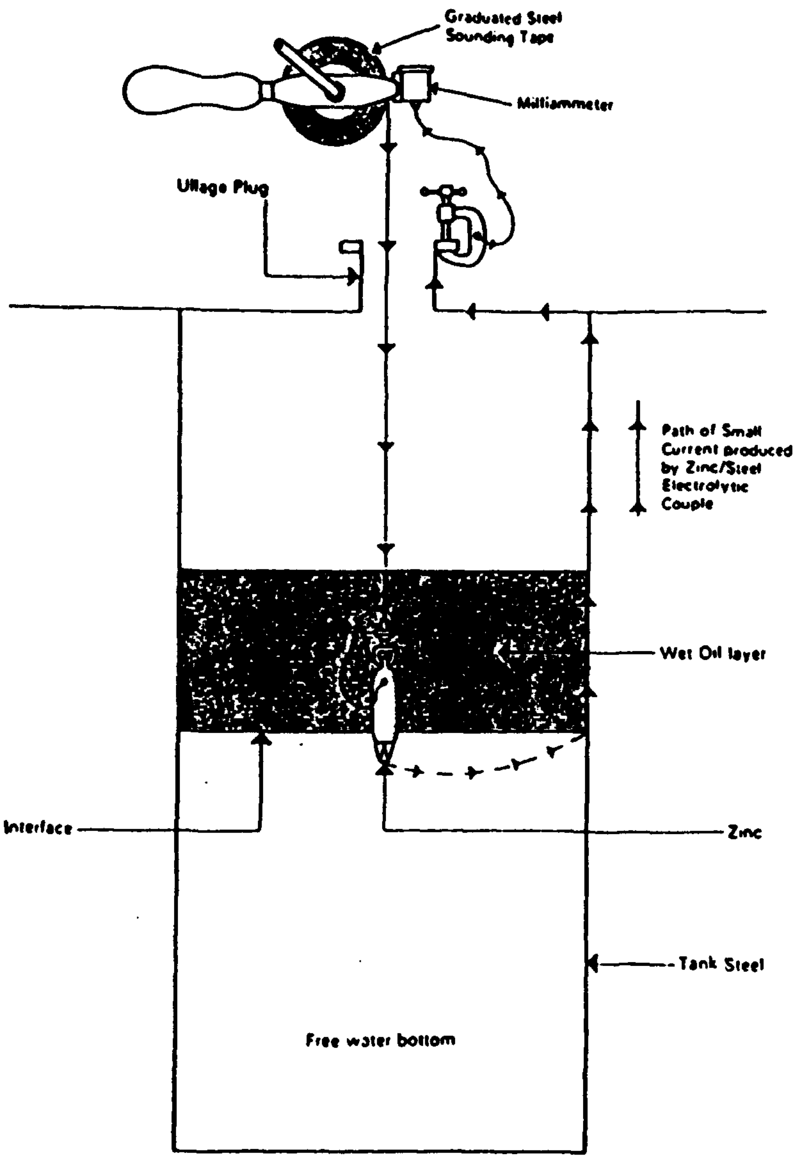

Figure 8. Modified Ullage Tape [Ref. 27]

As noted in the preceding chapter, any discharge in-port or at-sea must be done in accordance with NSTM 593, which defers to the Oil Pollution Act of 1990 (OPA of 1990). No slops may be discharged within the "minimum prohibited zone," which is the area between a coastline and 50 miles out to sea. Some short voyages on coastwise transits preclude sufficient time past 50 miles to fully decant slops tanks.

Additionally, discharges beyond 50 miles are restricted by the "MARPOL CONVENTION." "MARPOL," short for maritime pollution, stems from the International Convention for the Prevention of the Pollution from Ships, 1973. MARPOL has the same limitations as OPA-90 and adds special areas such as the Mediterranean, Red Sea, and Persian Gulf [Ref. 12:p. 241]. Furthermore, the following extremely restrictive limits are imposed:

a. Ballast water (dirty) discharged in prohibited zones cannot exceed 15 part per million (ppm) of oil.

b. Beyond prohibited zones the total oil discharged per voyage may not exceed 1) 1/30,000 of a tanker's deadweight tonnage and 2) no instantaneous flow rates of effluents of greater than 60 liters per mile are permitted. [Ref. 12:p. 245]

The actual liters per mile can be calculated using the formula shown below. It is constrained to be less than or equal to 60 if the flow rate of effluents is to meet the 60 liters per mile requirement. [Ref. 27:p. 32]:

$$\frac{\text{(PPM OF OIL IN EFFLUENT) X (EFFLUENT DISCHARGE RATE IN } M^3\text{/HOUR)}}{\text{SHIP'S SPEED IN KNOTS X 1,000}}$$

Thus, different combinations of effluent content, discharge rate and speed can generate the 60 liters per mile limit. Most tankers in normal weather can maintain this limit. Oil at 60 liters per mile quickly spreads and dissipates within 2 to 3 hours.

Depending on the vessel, slop tank capacity, crew proficiency, and previous cargoes, the number of voyages[20] made before the slops must be disposed of varies from ship to ship. For instance, a USNS Sealift Class tanker has a forward slops tank with a capacity of 5,500 bbls. and an engine room slops tank of 700 bbls. The other predominant class of tanker, the T-5's, has roughly the same slops tank capacity with 4,884 bbls. On the average, these tankers can make approximately four voyages before they have to discharge or start encroaching upon cargo carrying capacity by storing slops in cargo tanks. [Ref. 29] Fortunately, past incidences of slops build up from MSC tankers encroaching on cargo carrying capacity are rare. [Refs. 4 and 29] But, this could arise in the future.

3. Slops Disposal

Disposing of slops generated by tank washings in the interest of product integrity is becoming a difficult issue for MSC in terms of operations and costs. An examination of the background, operational problems and associated costs of slops disposal is necessary to fully appreciate the complexity of this issue.

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[20]Ref. 5:p. C-2-44, defines a voyage as "commencing on arrival at a loading port and ending when a MSC Force Tanker arrives at the next loading port after having discharged its previous cargo."

Instructions [Ref. 5] guide Masters to consult the latest edition of COMSCNOTE 3170; Subject: Shore Deballast Facilities List to determine the availability of reception facilities at the next load port. Reference 5 says, "when no loading terminal deballast facilities are available, and less than 2% of the available cargo would have to be shut-out, slops will be retained for disposition at the next port call where suitable facilities are available." On the other hand, if more than 2% of the new cargo would have to be reduced, the Master or operator must determine the availability of local commercial barge removal services and request authorization for such services from COMSC.

Terminals that receive ocean-going tank vessels of all sizes have to provide a service of receiving oily waste from these ships. The terminal can receive the waste directly, or can have an outside vendor come to the terminal to receive the waste and transport it away with tanker trucks. The service is intended to aid in reducing pollution of the oceans, and is a result of an international agreement of the world's maritime nations. The United States is a signatory nation to this agreement, known as MARPOL 73/78 (International Convention for the Prevention of Pollution from Ships 1973, as modified by the protocol of 1978). U.S. Coast Guard Captains of the Port (COTPs) enforce this with Title 33, Code of Federal Regulations, Parts 151 and 158 (33 CFR 151 and 158). [Ref. 30] Thus, shoreside facilities are required, once certified by the COTP, to receive ships' tank washings.

Three types of shoreside recycling facilities are available to MSC tankers. They are Defense Fuel Support Points (DFSPs), commercial refineries, and commercial waste disposal contractors. Depending upon the

port a M(~ tanker calls upon, one of these three sources will be utilized when disposal is necessary (i.e., the slops tanks are full). All three categories of facilities present common and unique problems in disposal. Most problems relate to delay in port, which can seriously impair tanker operating efficiencies.

B. ISSUES

1. Disposal

Presently, MSC tankers have more difficulty in disposing of slops in U.S. West (includes Alaska) and Gulf Coast ports than anywhere else in the world due to local and state environmental regulations. Shoreside facilities in these areas flatly reject disposal requests once chemical analysis of slops reveals the presence of hazardous waste, such as heavy metals which may be present as a result of engine room slops being commingled with tank .ashings. Consequently, hazardous waste must then be disposed of at state-certified hazardous waste disposal sites. This is an extremely expensive alternative; costs can reach up to $12.81 per bbl. [Ref. 31]

These two areas of operation, U.S. Gulf and West Coasts, represent a significant portion of tanker traffic when assessed in terms of long tons transported. In FY 1992[21], these two areas comprised 35% of the long tons *loaded* [Ref. 6:p. A-6]. Having performed tank cleaning enroute in preparation for onload means that most of the tankers would

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[21]FY 1992 is a more representative year to examine traffic in long tons because the bulk of petroleum for Desert Shield/Storm had already been moved during FY 1991.

have arrived at these ports with slops. Thus, over one third of the areas of origin represent the most expensive and difficult regions in which to dispose of slops. Furthermore, with ever-increasing sensitivity to the environment, the U.S. East Coast and overseas ports will surely present similar difficulties in the near future as their laws attain the level of regulation of that of the U.S. West and Gulf Coast ports. The first type of recycling facilities, DFSPs, is reportedly capable of receiving all oily waste except JP-4 residue. JP-4, which has a flashpoint of less than 140 degrees F., is deemed too volatile to handle. Additionally, it contains benzene, a hazardous material.[22] All DFSPs present the following problems with respect to disposal [Refs. 32 and 33]:

1. Refuse JP-4 slops.
2. Receive JP-5 and Diesel slops with qualifications (high flashpoint slops only).
3. Require oily waste slops analysis before acceptance and receipt. This requirement can delay the operations for two or more days. The lab analysis is done to ensure that the ship has not introduced metallic elements, such as arsenic from engine room slops into the cargo slops mixture.
4. Shut-down of oil waste (slops) facilities due to breakdowns, cleaning, or insufficient ullage.

The second type of recycling facility, commercial refineries, presents some problems not encountered at DoD facilities. Refineries are under contract to DFSC only to manufacture petroleum products. Therefore,

[22]JP-4 is presently being withdrawn from the DoD fuel inventory and is being replaced by JP-8. The reasons for this shift are twofold. First, switching to JP-8, which has a flashpoint greater than 140 degrees F. (and no benzene) enhances survivability of end user platforms. Secondly, supplying battlefield assets is simplified since JP-8 is going to be a common fuel for many of those assets. [Ref. 7] (JP-4 is considered a hazardous material due to its low volatility and lead content from benzene).

each refinery may differ in the type of recycling services provided. Examples of some of the predominant problems are [Refs. 32 and 34]:

a. Accept oily waste since the refinery is a state-certified hazardous waste disposal site. Depending on the coast, the related costs can be very high. In addition, required sampling and analysis can result in excessive delays; sometimes up to five working days.

b. Accept oily waste only if it is a residue of a load lifted from *that* facility. Refusals to accept oily waste not generated from that particular refinery are based upon, in some instances, the state's Health and Safety Code. Additionally, the cost of disposing of contaminated oily waste, (i.e., washings that have been commingled with engine room slops) can cost up to five times that of oily waste. "Generic" oily waste runs around $1.00 per bbl. to dispose of.

The third type of recycling facility, state-certified commercial waste disposal contractors, is notoriously expensive with costs starting at about $6.00 per bbl. Furthermore, these contractors require sampling and analysis with the concomitant delays.

Ideally and legally, recycling facilities are supposed to have sufficient capacity and transfer rates to receive residue/water mixtures for the types of cargoes handled at the terminal or port. When tanker operators find these conditions not satisfied, they are required to report inadequacies to the U.S. Coast Guard Captain of the Port (COTP) in U.S. ports and to the Commandant of the Coast Guard for foreign ports in accordance with USCG Navigation and Vessel Inspection Circular (NVIC) No. 4-87, which provides definitions and a report format. [Ref. 35]

Presently, MSC does not have a feel for the scope or the number of problems operators encounter since many of them do not follow through with the filing requirements of USCG NVIC 4-87. Moreover, there is no formal feedback loop from the USCG to MSC on this matter. [Ref. 29] If problems are encountered during a tanker's port call, they are solved on an ad hoc basis between the facility, tanker operator, vessel agent, and local MSC representative. Under a provision in the tanker's time charter contract, the vessel operator is only obligated to notify the charterer (MSC) that the vessel has oil and water in the slops tank and that he is awaiting the charterer's instructions on the disposition of slops.

2. Volume

Slops retention figures aboard MSC tankers, cited in gas-free waiver requests, have been questioned by DFSC. Before jumping to conclusions that the amounts are excessive, several factors must be taken into consideration [Ref. 27:p. 91]:

1. The characteristics of the preceding cargo, persistent or easily removed, such as lube oil or gasoline.
2. The amount and type (machine or manual) of tank washing.
3. The length of the voyage and conditions, rough or smooth, and whether sufficient time was allowed for settling once tank washing effluent was transferred to the slops tank.
4. The proficiency of the crew in accurately ullaging the slops tank.
5. The degree of decanting of the slops tank.

The most likely explanation for the large volume of slops being held onboard may have to do with voyage length. If the typical voyage length is so short that there is insufficient time to permit separation as a function of specific gravities, as in the case of the T-5 and Sealift

Classes, then slops onboard may have a higher water content than otherwise might be present if the voyage length permitted sufficient settling after tank washing.

3. Waste

The total monetary amount of oil lost is not insignificant. After a refined product carrier completes discharge, all the cargo tanks are stripped dry. Usually, there are puddles in tank low spots which amount to a few gallons. But, as one Master stated [Ref. 36], "... due to the normal configuration of the pipelines and clingage to the tank surfaces, an estimated five thousand gallons of product still remain there, and thus are lost during each tank cleaning." This loss is transferred to the tanker's slops tank, and ultimately discharged to a recycling facility. Therefore, this transfer is an economic loss to the government. At a nominal price of $.90/gallon, this amounts to $4500.00 for each tank cleaning for only one tanker. Furthermore, it might be said that each gallon of such disposed fuel is "paid for twice" by the government, once at purchase and again at disposal. Consequently, this amount can multiply rapidly in a year's time across all MSC chartered tankers.

C. PROPOSED SOLUTIONS

Some solutions proposed by MSC and its area offices are:

1. Coordinate with USCG COTPs to obtain feedback on what constitutes refusal under CFR 33 when commercial refineries reject slops. [Ref. 37]

2. Verify refineries' authority to refuse slops on the basis that the slops did not originate from a cargo processed at that refinery. [Ref. 33]

3. Adopt a contractual clause in MSC charters that prohibits tanker operators from pumping bilges into slops tanks and segregated ballast tanks[23]. Furthermore, attendant language should be included that holds the tanker operator liable for costs associated with the removal of hazardous waste if slops are contaminated with engine room bilge water. [Ref. 33]

4. Separate slops into two tanks for accounting purposes. DoD generated cargo would come under the government's account while all other slops associated with the operation of the vessel would come under the operator's account. [Ref. 37]

5. Include as an addendum into SOM COMSCINST 3121.9 instructions to ship's Masters the requirement to keep tank slops and engine room slops segregated. Plus, require the Masters to submit reports of inadequate reception facilities in accordance with USCG NVIC 4-87. [Ref. 37]

6. DFSC should work through the DFR's and Naval Base Commanding Officers to ensure the DFSP's are always ready to and capable of accepting slops, with the exception of hazardous waste, such as low flashpoint or leaded wastes. [Ref. 33]

7. DFSC should negotiate contracts with ports worldwide to accept the full range of slops generated by MSC tankers. [Ref. 33]

The slops disposal situation is rapidly approaching serious proportions due to the inability of government-controlled tankers to legally dispose of tank washings/oily waste/slops ashore. Additionally, it appears to be exacerbated by the amount of tank cleaning MSC tankers are required to perform by DFSC in the spirit of quality control. Finally, from MSC's perspective, this problem appears to not be of concern to DFSC.

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[23]Segregated ballast tanks (SBT) are completely separated from the cargo oil and fuel systems, and permanently allocated to the carriage of water ballast. The intent of this requirement is to provide vessels with enough segregated ballast capacity so that the ship may be operated safely on ballast voyages without putting water ballast in oil tanks except in unusually severe weather. Conversely, having an SBT system is suppose to alleviate the need to put cargo products in *those* tanks, and then risk exceeding discharge limits of the environment when SBTs are pumped overboard in the course of normal operations. [Ref. 38]

D. CONCLUSION

The ultimate goal of MSC and DFSC should be to minimize creating slops. This chapter has shown that tanker's ability to efficiently discharge slops at sea is contingent upon a rare balance of the following conditions: weather, voyage length, speed, distance from shore, volume of slops, equipment reliability, and crew efficiency.

Complicating the issue of tank cleaning are environmental initiatives at sea and ashore which are rapidly eliminating efficient and cost-effective options in slops disposal. A relaxation of pollution laws is highly unlikely. Indeed disposal laws can be expected become more restrictive as environmental pressure continues to grow.

MSC and DFSC have much to gain by renewing dialogue regarding the issues presented here.

VII. ANALYSIS OF ISSUES

A. INTRODUCTION

This chapter will examine the MSC versus DFSC differences about and propose resolutions. It will also compare government and commercial tanker operations to assess applications from the commercial world for government operations.

B. TANK CLEANING; MSC VERSUS DFSC

At the heart of the tank cleaning issue is the DLA requirement for internal tank inspections at commercial refineries for which the cargoes are FOB origin lifts. The other kinds of lifts T-5 and Sealift tankers perform are those for government-owned products loaded from DFSPs destined for other DFSPs or for consolidation into Naval Fleet Auxiliary Force oilers. The majority of the lifts are the former [Ref. 4].

While MSC appreciates the need for product integrity and tank washing, MSC questions the necessity for tank inspections (which require that the tanks be washed, gas-freed, and slops disposed of) when product compatibilities may allow for, in essence, a "load on top" waiver, particularly for same product lifts. Granted, some washings may be less intensive than others, such as the bottom wash, in the case of JP-5 to JP-5 (See Appendix E), but the point that MSC emphasizes is that tanks are still being washed, slops still created, and disposal costs, which are rising, must ultimately be incurred by the government, even in these same product

situations. Furthermore, these evolutions are dangerous and risky to personnel, tankers, and the environment. MSC questions whether all this is really necessary.

DFSC-Q seems to think so. Despite the inconsistencies cited in the conclusion of Chapter IV, DFSC-Q does not appear to be willing to compromise. However, there is room for improvement, and these recommendations are suggested:

a. Reduce or eliminate inspection requirements for bareboat and time charter vessels for same product loads. DFSC should place confidence in the government's IQUE program at the refinery, the QAR's experience and corporate knowledge, fuel samples and ultimately the P and I clause in a tanker's contract, which provides coverage for product contamination, and the latent defects clause in DFSC bulk fuel contracts for claims against the refinery.

b. MSC should investigate the feasibility and cost-effectiveness of cycling tankers into maintenance availabilities for a recoating of cargo tanks. With the present required amount and type of cleaning, a tank coating's condition will deteriorate rapidly. Also, installing steam heating coils that expedite the settling of slops could be performed in the same period.

C. COMPARISON OF GOVERNMENT AND COMMERCIAL TANKER OPERATORS

1. Operating Costs

Parallels can be drawn between government and CSC tankers operations. First, tanker demand in both cases is significant. And, second, both fleets of tankers are limited and constantly busy. Due to

their longevity of service, the government's fleet of time and bareboat chartered T-5s and Sealift class tankers can be likened to CSC's fleet of Chevron-owned tankers. However, CSC's fleet is self-insured and operating costs are paid for by Chevron, while the government's fleet must carry insurance through each tanker's operating company.

Since MSC is funding the entire operation in bareboat charters, costs that MSC incurs with the bareboat charters are reflected in the per diem rate charged to DFSC. For the time chartered T-5s, MSC pays the owners a fee to operate the ship and reimburses the owner for fuel costs and port charges. Time to perform tank cleaning consumes fuel. Thus, in both kinds of charters MSC must recover the costs of tank cleaning in the per diem rate it charges DFSC. DFSC, in turn, passes these costs on to its customers as part of the transportation surcharge, which is added to the price of fuel. However, MSC and DFSC operate within the DBOF, which seeks to cover all costs incurred. Consequently, the costs of tank cleaning in the interest of quality are not of as much concern to DFSC-Q as they keep in a profit-making organization.

2. Slops Reduction

Both government and commercial tanker operations are subject to the same environmental regulations and have like problems in slops disposal. However, CSC avoids creating slops in its tankers by using refined product washes where applicable, and by establishing stringent chartering requirements. On the other hand, MSC does not have the equipment or infrastructure to adopt refined product washes in the short run. MSC may, however, have more freedom in chartering. This subject will be discussed shortly.

3. Quality in Transport

Concerns for quality are practically identical between the government and CSC. Both have nearly identical guidelines for water washing tanks to preserve product integrity over a wide range of ***clean*** petroleum products. But MSC transports fuels for DFSC that are very sensitive to contamination from salt water or previous products, such as JP-5. Furthermore, JP-5 represents a significant portion of MSC tankers' workload. For instance, during Operation Desert Shield/Storm/Sortie, JP-5 comprised 27.6% of the total barrels of products transported [Ref. 6:p. A-9]. Consequently, MSC will always have to manage the slops issue due to the products' variety and sensitivity.

Presently, MSC must react to DFSC tasking. Therefore, when opportunities appear for "load on top" lifts, MSC will submit a Gas-Free Waiver Request. *DFSC-Q then considers the request for a process already* set in motion, for the tanker is usually one lift away from the next load.

D. ANALYSIS

This process is too reactive. The last product in that tanker is not initially considered by DFSC-Q since DFSC-Q assumes tanks will be washed for QAR inspections mandated by DLA FOB origin lifts. It is only when MSC raises the question of product compatibility to DFSC-Q that DFSC-Q will consider "loading on top."

There may be potential for MSC's Tanker Division and DFSC's Operations and Inventory Division to coordinate lifts with tankers that have carried like or higher grade products. Then DFSC-Q may be more likely to grant a

waiver if all of DFSC-Q's other concerns (discussed in Chapter III) are satisfied.

To fill the gap left by matching time and bareboat chartered tankers matched to products, MSC might spot charter vessels as CSC does. By requiring identification of the last three products carried and tanks prepared for QAR inspection in accordance with Reference 9, MSC would shift the risk and cost of slops disposal to the potential charter before it was contracted for government service. This, of course, is predicated on sufficient supply of qualified U.S. flagged tankers. DFSC-Q would then be satisfied since MSC is literally presenting vessels for QAR's inspection.

To ensure the vessel is satisfactorily prepared for a QAR's inspection, MSC might include a penalty clause in the spot charter's contract for delaying product lifts if tanks are not prepared. Thus, in a sense, funds received from claims resulting from these clauses could be applied towards the costs of either tasking a time/bareboat charter or another spot charter for that lift. Consequently, the risk of moving a product load late will have to be recognized and assessed beforehand by MSC and DFSC.

As mentioned earlier, slops will still be created on time and bareboat charters, but MSC might be able to coordinate with DFSC-OII for extra time in a voyage which would allow time for settling and decanting, while still complying with MARPOL limits. The cost of keeping a tanker at sea could be weighed by MSC against the cost of disposal ashore in order to strengthen MSC's case.

Not to be forgotten in this issue of avoiding the creation of slops are the tanker operators, themselves. They may be contributing to the problem by excessive ballasting of cargo tanks, despite having SBTs. This practice is one of DFSC-Q's concerns. Underscoring this issue may be the fact that operators have no incentive ***not to create slops***. Operators seem to view their function as just that of preparing tanks and carrying cargo. It appears that once they have slops, their attitude is that it is MSC's problem if not all the slops can be disposed of at sea due to time, distance from shore, amount, etc.

Reference 26, pages 89-90, cites experiments performed with SBT capable tankers which did not take on "dirty ballast" in most voyages. Normally, the amount of ballast required for safe and efficient handling is 35% to 40% of DWT in good weather and 50% to 60% of DWT in severe weather [Ref. 26:p. 89]. The experiments performed showed that tankers could operate at ballast levels of 35% to 40% on the vast majority of all ballast voyages regardless of the weather encountered. Thus, the question arises of how necessary are ***all*** the ballastings that the operators perform over a period of time? MSC might wish to audit the ball ng practices of its operator.

In conclusion, financial survival and risk of litigation from environmental accidents have forced CSC to solve the problems MSC is experiencing. The distinct advantage CSC has over MSC is that all the concerns of quality, scheduling, operating costs, and chartering are under one authority; namely, CSC. On the other hand, in the government's case these issues are not under one authority. They are currently narrow concerns of various divisions of two activities, MSC and DFSC.

Consequently, such compartmentalization has handicapped any efforts towards solving the problems in government tanker operations. However, MSC N3T is seeking to broaden and integrate all the division's concerns, improve communications between MSC and DFSC, and save the government money.

VIII. SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

A. SUMMARY

The purpose of this thesis has been to examine MSC tanker operations, tank cleaning requirements, disposal complications, DFSC's policy in granting Gas-Free Waiver Requests, and commercial tank cleaning practices. The preceding chapters have attempted to objectively explore the operating environment and MSC's and DFSC's perspectives and concerns.

Chapter I introduced the tank cleaning issues, the thesis objectives, and the analysis process to be followed in examining the issues. Chapter II examined MSC tanker operations by focusing on tasking and the nature of cargo tank cleaning. The type of charters for tanker vessels were also discussed and issues germane to the tank cleaning issue were presented. Chapter III explained DFSC's mission in fuel management. It focused on quality control checkpoints relevant to the movement of clean petroleum products in MSC tankers. It also presented the rationale behind the concern over fuel quality. Chapter IV focused on Gas-Free Waiver Requests submitted by MSC to DFSC. It cited MSC's justifications for not cleaning tanks and it presented DFSC's perspective in granting those requests. Chapter V described the harsh influences on commercial tanker companies and the essential characteristics for their survival. Chevron Shipping Company's (CSC) operations and practices with regards to the carriage of clean petroleum products were presented. Chapter VI extensively examined the background and problems of slops disposal. Chapter VII analyzed

differences between MSC and DFSC towards tank cleaning and compared commercial and government tanker operations. And, finally, this chapter will briefly review conclusions and propose recommendations.

B. CONCLUSIONS

The issue of modifying tank cleaning requirements for government service tankers is complex and difficult. However, government practices and requirements have revealed some inconsistencies where modifications may yield incremental improvements in cutting costs. If some of these inconsistencies are explored by opening communication channels between MSC, DFSC-OII, and DFSC-Q, then benefits may possibly be realized. Certainly, in light of DoD downsizing, the amount of petroleum consumption will decrease and reveal opportunities for savings. For instance, since JP-4 is being replaced by JP-8, a much less hazardous and volatile fuel, the frequency of tank cleaning to remove the lingering effects of JP-4's lead content and low flash point will potentially allow more opportunities for "load on top waivers."

MSC seeks greater economy in its operations by requesting Gas-Free Waivers when it appears all quality concerns are satisfied. Unfortunately, this process is too reactive and contributes to DFSC-Q's reluctance to grant these waiver requests. DFSC-Q is highly justified in its concerns for quality. There is a long track record of fuel contamination causing aircraft accidents or expensive engine repairs. Therefore, relaxing the present tank cleaning requirements is a new issue that carries significant risks. Consequently, DFSC-Q'S hesitancy in granting Gas-Free Waiver Requests is understandable.

While DFSC-Q's concerns are valid, there appears to be a system of quality checks and balances in place that will achieve DFSC's desired goals. This system is comprised of the IQUE (In-Plant Quality Evaluation) program, the QAR's corporate knowledge of the tankers, and the "First-in," and "Composite" samples. In addition, the P and I clause in MSC contracts and latent defects clause in bulk fuel contracts should ensure responsibility on part of the tanker operators and refineries.

The IQUE program's primary objective is to ensure acceptance of conforming products. One of the IQUE's main activities is to provide product audits on a continuing basis to determine that the refinery is adequately detecting defects in the processes that span from refining to delivery into a cargo tanker.

Since T-5s and Sealifts are operated under a time and bareboat charter, respectively, they sail on mostly regular schedules. Thus, QARs consistently see these tankers and crews. Most of the time a QAR can predict what the conditions will be like in a particular ship's cargo tank. Essentially, then the QAR's internal inspection serves only as a verification of the crew's thoroughness in complying with instructions set forth in MIL-HDBK-291(SH), Figure 25 "Cargo Tank Cleaning Requirements."

Finally, MSC instructions and contracts [Refs. 5 and 15] with its operators should sufficiently protect the government's interests in assuring a crew's compliance with quality and environmental directives.

MSC Sealift Class tankers, in particular, are showing their age as evidenced by the declining material condition of their cargo tanks. It may be possible that repeated tank washings at 135 degrees F. and 100 psi

are ***actually contributing to the deterioration*** of the cargo tanks' condition by progressively removing tank coatings and promoting rust.

The essential benefit of tank washings is to remove the lingering effects of previous products. But, when previous and successive products are the ***same***, washing tanks may actually create more sediment and rust than is removed given the fact that the tanks' coatings are already "scarred." It would seem that this scenario would only create an unnecessary amount of slops due to the excessive amount of rinsing required to remove ***newly created*** sediment.

Complicating the issue of tank cleaning are environmental initiatives at sea and ashore which are rapidly eliminating efficient and cost-effective options in slops disposal. A relaxation of pollution laws is highly unlikely. Disposal laws will become more restrictive as environmental pressures continue to grow.

The environmental aspect is particularly relevant for short ballast voyages between product loads on the U.S. West Coast. The U.S. West Coast is the area of origin of 35% of the total long ton petroleum traffic for all types of tanker charters [Ref. 6:p. A-9]. It is also the most expensive area for slops disposal and it is also nearly impossible to dispose of slops inport there without unacceptable delays. Ironically, some of those delays, as discussed in Chapter VI are caused by government facilities (DFSPs).

The ultimate goal of MSC and DFSC should be to minimize creating slops while protecting the integrity of aviation, shipboard, and other petroleum products. Potential savings may be realized through improved planning in scheduling and communications that strive for eliminating redundant

requirements in the transportation spectrum. The following recommendations are suggested to accomplish that.

C. RECOMMENDATIONS

1. Tank Inspections

a. Reduce or eliminate inspection requirements for bareboat and time charter vessels for the same product loads. DFSC should place confidence in the government's IQUE program at the refinery, the QAR's experience and corporate knowledge, fuel samples taken during and after onload, and the P and I clause in a tanker's contract which provides coverage for product contamination, and the latent defects clause in DFSC bulk fuel contracts.

b. MSC should investigate the feasibility and cost-effectiveness of cycling tankers into maintenance availabilities for a recoating of cargo tanks. With the present required amount and type of cleaning, a tank coating's condition can be expected to deteriorate rapidly. Also, installing steam heating coils that expedite the settling of slops could be performed in the same period.

2. Slops Reduction

1. Improve planning in scheduling between DFSC-OII and MSC N3T. Presently, the process of submitting Gas-Free-Waiver Requests is too reactive since requests are submitted in response to assignments from DFSC-OII. By assuming a proactive approach, MSC and DFSC-OII might be able to match lifts for cargoes to vessels that had just carried the same product or one of a higher grade. The ideal objective is to not create slops by washing tanks in the first place. DFSC-Q may be more likely to grant Gas-Free Waiver Requests in these instances.

2. MSC might examine the cost-effectiveness of spot-chartering tankers in order to avoid cleaning the bareboat and time charters more than necessary. Ultimately, the cost of spot charters, already prepared

for carriage of a specific product since it was a specification identified upfront in the bidding process, may be less than the future long-run costs of slops disposal.

3. MSC N3T and DFSC-OII should schedule slack in voyages in order to allow for thorough settling of slops and time for complete decanting.

4. Gas-Free Waiver Requests should be expanded in scope and timeliness. If DFSC-Q knows upfront details such as tank composite results from previous discharges, QARs comments, and whether salt water ballast was placed in cargo tanks, DFSC-Q might gain a better picture of tank conditions and then be less hesitant to grant a waiver.

5. DFSC-Q should conduct a dialogue with DCMC QARs involved in the IQUE program in order to assuage any apprehensions on DFSC-Q's part regarding a refinery's dedication to quality practices.

6. MSC should start a dialogue with the USCG to identify non-government facilities that are illegally refusing slops. Also, MSC should require operators who experience disposal problems any at facility to submit reports in accordance with Reference 35.

7. MSC should continue to pursue solutions already proposed by its activities. These were cited and discussed in Chapter VI.

8. MSC should renew dialogue with DFSC's Facilities Branch to target and solve these problems.

9. MSC should also audit its operators' ballasting practices to see if dirty ballast is being created unnecessarily.

10. MSC should investigate the feasibility of lighter ballasting practices in order to avoid putting salt water ballast in cargo tanks.

3. Refined Product Washes

MSC and DFSC should investigate the feasibility and practicality of refined product washes like those that Chevron performs with its company-owned tankers. For example, if stocks of off-specification or higher grade fuel being stored on-site for shore boilers could be loaded and offloaded, effectively "rinsing" the tanks, then a previous product's lingering effects and other undesirable elements might be removed.

Special considerations will have to be given to the impact of tanker scheduling and the contractual obligations of remaining inport for a greater length of time.

4. Communications

MSC and DFSC should continue to bridge communications gaps in order to appreciate each other's perspectives. Perhaps an exchange program between various divisions would expedite efforts to solve common problems. Certainly, regularly scheduled meetings of the involved parties to exchange ideas and develop consensus are appropriate.

APPENDIX A

MSC Tanker Fleet
Updated: 4 August 1993

Ships Name	Flag	CONSOL Capable	Segregated Ballast	Nominal Capacity	Draft	DWT	OTHER
T-5 (Champion) Class:							
Paul Buck	US	Y	Y	235,000	36'00"	30,600	
Sam Cobb	US	Y	Y	235,000	36'00"	30,600	
Gus Darnell	US	Y	Y	235,000	36'00"	30,600	
Laurence Gianella	US	Y	Y	235,000	36'00"	30,600	
Richard Mattheison	US	Y	Y	235,000	36'00"	30,600	
Sealift Class:							
Antarctic	US	Y	C	185,000	34'07"	23,000	
Arabian Sea	US	Y	C	185,000	34'07"	23,000	
Arctic	US	Y	C	185,000	34'07"	23,000	
Atlantic	US	Y	C	185,000	34'07"	23,000	
Caribbean	US	Y	C	185,000	34'07"	23,000	
China Sea	US	Y	C	185,000	34'07"	23,000	
Indian Ocean	US	Y	C	185,000	34'07"	23,000	
Mediterranean	US	Y	C	185,000	34'07"	23,000	
Pacific	US	Y	C	185,000	34'07"	23,000	
Other Tankers:							
Potomac	US	N	N	175,000	34'00"	27,467	OPDS
American Osprey	US	N	N	268,000	36'00"	34,723	OPDS
T-1 Tankers/Barges							
Valiant	US	N	N	50,309	22'08"	6,944	
Bravado	US	N	N	28,000	23'06"	4,491	
Seneca	US	N	N	42,000	14'05"	5,330	ITB

Y - Yes
N - No
C - Means certified for use as segregated ballast
OPDS - Vessel equipped with Over-the-Shore Petroleum Discharge System
ITB - Integrated Tug/Barge

APPENDIX B

TABLE 1. Critical contamination factors and possibilities.

Succeeding cargo	Preceding cargo and effect of contamination
Gasolines	- White or black diesel fuel, lube oil: As little as one-third of a barrel of any of these oils can contaminate 8000 barrels of gasoline by increasing gum content. - Dyed kerosene: Some commercial kerosenes may be dyed after loading. The dye power will adhere to bulkheads and impregnate the scale above the liquid level and thus impart a color to subsequent white products.
Kerosenes	- Gasoline: Small quantities will affect the flashpoint. - Black oils: Very small quantities will impart a color (see dyed kerosenes under gasolines).
Jet fuels: JP-4	- Diesel fuel: Small quantities will affect the freezing point. - Black oils: Since jet fuels are good solvents, small quantities of black oils will increase gum content. - Gasoline: Small quantities may affect the flashpoint and explosibility.
JP-5	- Black oils: Small quantities will precipitate sludge in JP-5 fuel; even minute traces of black oil will reduce the water-separating ability of JP-5. - Gasoline: Small quantities will affect the flashpoint and explosibility.
Diesel fuels	- Gasoline jet fuel and kerosene: Small quantities will affect the flashpoint. - Black oils: Small quantities of some black oils will precipitate sludge in diesel fuel; even minute traces of black oils will reduce the water-separating ability of diesel fuel.

TABLE 1. Critical contamination factors and possibilities. - Continued

Succeeding cargo	Preceding cargo and effect of contamination
Boiler and burner oils	- Gasoline: Very small quantities will affect the flashpoint and explosibility.
Lubricating oils	- Special precautions are necessary in cleaning prior to loading bulk lubricating oils. Such cleaning should be accomplished under the supervision of the cognizant petroleum inspector in accordance with MIL-HDBK-200. For effect of contamination of lubricating oils see MIL-HDBK-200.

5.8.6 Chart for cargo tank cleaning. The chart for cargo tank cleaning (see figure 25) shall be a guide to the proper tank cleaning operations to be carried out between cargoes. It shall not, however, relieve the ship's officers of the responsibility of exercising good judgment or observing safety. The following conditions shall be observed while using the chart for cargo tank cleaning:

(a) Each cargo tank shall be proven gas-free (see 5.7.1) prior to the entry of personnel. Safety precautions concerning the personnel working in tanks and compartments shall be strictly enforced.

(b) To avoid delays at a loading port, all necessary cleaning of cargo tanks, pipelines, vent lines and heating coils shall be accomplished prior to arrival. Tank tops shall be ready to open for inspection. Only tankers with clean ballast shall be permitted in port, except those in black oil service.

(c) During loading and discharging, tank cleaning or gas-freeing operations, officers shall investigate for leaks which may develop in bulkheads, pipelines, valves or heating coils. To avoid any delay, this information, which will directly affect the ship's cargo nominations and cargo segregation plans, shall be given immediately to the home office, as well as to military inspectors and oil company field representatives boarding the ship.

6. NOTES

6.1 Subject term (key word) listing.

Cargo
Cleaning
Piping
Safety precautions
Tanks

APPENDIX C

TABLE II
GUIDE FOR PREPARATION OF CARGO TANKS

LAST CARRIED ↓ / PRODUCT TO BE LOADED →	AV GAS MO GAS (5)	JP-4 JET B	JP-5 (7) JP-8 JET A/A-1	KERO-SENE DF-A	F-76 DF-1/2 FS-1/2	FS-4/5/6 NSFO	JPTS JP-7	LUBE OILS	CRUDE OILS
AV GAS MO GAS (LEADED)	A	BF	BF	B	B	B	(3)	E	A_1
MO GAS, U/L JP-4 JET-B	A	F	BF	B	B	B	(3)	E	A_1
JP-5 JP-8 JET A/A-1 KEROSENE DFA	A	F	F	A	A	A	(3)	E	A_1
F-76 DF-1/2 FS-1/2	C	CF	CF	C	A	A	(3)	E	A_1
FS-4/5/6 NSFO	NO LOAD (1)	NO LOAD (1)	NO LOAD (1)	NO LOAD (1)	D	A	(3)	E	D
JPTS JP-7	A	F	F	A	A	A	(3)	E	A_1
LUBE OILS (4)	D	DF	DF	D	D	A	(3)	E	A_1
COMMERCIAL DIESEL FUEL	D	DF	DF	D	D	A	(3)	E	A_1
MOLASSES TAR, WAX	NO LOAD	NO LOAD	NO LOAD	NO LOAD	D (1)	D	(3)	E (1)	E
CRUDE	NO LOAD	NO LOAD	NO LOAD	NO LOAD	D (1)	A	(3)	NO LOAD	A_1
GRAIN	B	(2)	(2)	B	B	B	(3)	E_1	B
ORE	NO LOAD	NO LOAD	NO LOAD	NO LOAD	B	B	(3)	E_1	E
COAL	NO LOAD	NO LOAD	NO LOAD	NO LOAD	B	B	(3)	E_1	E
HEAVY, HI-SULFUR CRUDE	NO LOAD	NO LOAD	NO LOAD	NO LOAD	D_1	E_1	(3)	NO LOAD	A_1

NOTES FOR TABLE II

A. All cargo lines will be dropped, tanks stripped, ballast residue removed, and cargo tanks gas freed to permit entry and inspection.

A[1]. No specific preparations required if lines have been dropped and tanks stripped.

B. All cargo and vent lines will be drained of previous product and flushed with cold water. Cargo tanks will be thoroughly machined washed using cold water. Cargo tanks must be free of water, loose rust, sludge, mud, silt, etc.

C. The same as for B. except that hot water will be used instead of cold. If tank interiors are coated, water temperature should not exceed 135°F.

D. Cargo tanks and systems will be processed in accordance with the instructions contained in NAVSHIPS 0900-16-0010, Manual for Cargo Tank Cleaning.

E. Cargo tanks and systems must be cleaned in such a manner as will remove all rust, scale, sediment, and all traces of previous cargo and water.

F. After dropping lines, hand hose tank bottoms, and remove all puddles of [illegible]r from bottom surfaces.

(1) Vessels which have carried linseed oil, cottonseed oil, tar, wax molasses, or other products which would probably contaminate the cargo to be laded will be rejected unless cleaned in accordance with D. and have carried (after cleaning) at least two cargos of clean product.

(2) Vessels will not go directly from grain to jet fuel service.

(3) Special tank preparations and cargo handling is required for JP-7/JPTS to prevent contamination. Tanks used for lading must be coated with an approved epoxy. Coating must be adherent: No flaking, peeling, or blistering. It is mandatory that JP-7/JPTS be loaded in tanks in which the last product carried was JP-4, JP-5, kerosene, nonaromatic solvent, unleaded gasoline, or arctic diesel. Prior to loading JP-7/JPTS, tank cleaning requirements are: tanks must be machine washed with hot water. If cleaning chemical and/or salt water is used, the final wash must be with fresh water. Tank bottoms, interior bulkheads, and internals must be completely free of sediment, scale, and other contaminants. Tanks must be dry and all liquids completely removed from the tanks. Lines, after cleaning, must be flushed with fresh water, drained, and freed of all water. Loading and unloading system must be completely isolated. This will be accomplished by completely separate piping systems or by use of blinds. Valves will not be depended on to effect isolation. No common lines will be used, steam smothering lines should have at least two valves that can be sealed from the main line to the tanks, or a blind [illegible]lled that can be readily removed. Each tank will have its own individual [illegible]ne. If ship has a common vent system, tanks used for JP-7/JPTS must be isolated from balance of the vent system.

NOTES FOR TABLE II (CONTINUED)

(4) Vessels in which the previous cargo was lubrication oil must load and transport at least two clean cargos, after cleaning IAW the NAVSHIPS 0900-016-0010 manual prior to carrying aviation fuel.

(5) Vessels with zinc-type coatings will not be used to carry U.S. Government-owned/consigned leaded gasoline (aviation or motor). The cargo tank coating *must* comply with the requirements of class 1 (epoxy) or class 4 (urethane) of DoD-P-23236A (paint coating systems, steel ships tank). Class 2 (coal tar-epoxy), and class 3 (silicate, phosphate, or silicone zinc) are not acceptable.

(6) Vessels whose cargo tanks are coated with class 2 (coal-tar epoxy) coatings of DoD-P-23236A are *not acceptable to carry any* U.S. Government owned/consigned petroleum products. Vessels whose cargo tanks are coated with class 1, class 2, or class 4 DoD-P-23236A are acceptable to carry all U.S. Government-owned/consigned turbine fuels, diesel fuels, and fuel oils.

(7) All vessels' cargo tanks in which JP-5 turbine fuel is transported, must be coated with either class 1, class 3, or class 4 type coatings as identified above. Cargo tanks must have at least 80 percent of coating intact.

NOTE: Machine washing of cargo tanks referenced in paragraphs B, C, and (3) above, will be accomplished in accordance with the procedures contained in NAVSHIPS 0900-016-0018, Manual for Cargo Tank Cleaning, paragraph 6.3.

APPENDIX D

TABLE VI. Guide for preparation of cargo tanks

	PRODUCT TO BE LOADED								
LAST PRODUCT CARRIED	AVGAS MOGAS	JP-4 JET-B	JP-5 JP-8 JET A/A-1	KEROSENE DF-A	F-76 DF-1/2 FS-1/2	FS-4/5/6 NSFO	JPTS JP-7	LUBE OILS	CRUDE OILS
AVGAS MOGAS (LEADED)	A	BF	BF	B	B	B	(3)	E	A_1
MOGAS, U/L JP-4 JET-B	A	F	BF	B	B	B	(3)	E	A_1
JP-5 JP-8 JET A/A-1 KEROSENE DFA	A	F	F	A	A	A	(3)	E	A_1
F-76 DF-1/2 FS-1/2	C	CF	CF	C	A	A	(3)	E	A_1
FS-4/5/6 NSFO	NO LOAD (1)	NO LOAD (1)	NO LOAD (1)	NO LOAD (1)	D	A	(3)	E	D
JPTS JP-7	A	F	F	A	A	A	(3)	E	A_1
LUBE OILS	D	DF	DF	D	D	A	(3)	E	A_1
COMMERCIAL DIESEL FUELS	D	DF	DF	D	D	A	(3)	E	A_1
MOLASSES TAR, WAX	NO LOAD	NO LOAD	NO LOAD	NO LOAD	D (1)	B	(3)	E (1)	E
CRUDE	NO LOAD	NO LOAD	NO LOAD	NO LOAD	D (1)	A	(3)	NO LOAD	A_1
GRAIN	B	(2)	(2)	B	B	B	(3)	E	B
ORE									B

TABLE VI. Guide for preparation of cargo tanks - Continued

LEGEND:

A. All cargo lines will be dropped, tanks stripped, ballast residue removed, and cargo tanks gas freed to permit an entry and inspection.

A_1. No specific preparations required if lines have been dropped and tanks stripped

B. All cargo and vent lines will be drained of previous product and flushed with cold water. Cargo tanks will be thoroughly machine washed using cold water. Cargo tanks must be free of water, loose rust, sludge, mud, silt, etc.

C. The same as for "B" except that hot water will be used instead of cold. If tank interiors are coated, water temperature should not exceed 136 degrees F.

D. Cargo tanks and systems will be processed in accordance with the instructions contained in NAVSHIPS 0900-016-0010 "Manual for Cargo Tank Cleaning".

E. Cargo tanks and systems must be cleaned in such a manner as will remove all rust, scale, sediment and all traces of previous cargo and water.

F. After dropping lines, hand hose tank bottoms and remove all puddles of water from bottom surfaces.

(1) Vessels which have carried linseed oil, cottonseed oil, tar, wax, molasses or other product which would probably contaminate the cargo to be loaded will be rejected unless cleaned in accordance with D and have carried (after cleaning) at least 2 cargoes of clean product.

(2) Vessels will not go directly from grain to jet fuel service.

(3) Special tank preparations and cargo handling is required for JP-7/JPTS, to prevent contamination. Tanks used for loading must be coated with an approved epoxy. Coating must be adherent: no flaking, peeling, or blistering. It is mandatory that JP-7/JPTS be loaded in tanks in which the last product carried was JP-5, JP-4, kerosene, non-aromatic solvent, unleaded gasoline or arctic diesel. Prior to loading JP-7/JPTS tank cleaning requirements are: tanks must be machine washed with hot water, if cleaning chemical and/or salt water is used, the final wash must be with fresh water. Tank bottoms, interior bulkheads, and internals must be completely free of sediment, scale, and other contaminants. Tanks must be dry and all liquids completely removed from the tanks lines after cleaning, must be flushed with fresh water, drained and freed of all water. Loading and unloading system must be completely isolated. This will be accomplished by completely separate piping systems or by use of blinds. Valves will not be depended on to effect isolation. No common lines will be used. Steam smothering lines should have at least two valves that can be sealed from the main line to the tanks, or a blind installed that can be readily removed. Each tank will have its own individual vent. If ship has a common vent system, tanks used for JP-7/JPTS, must be isolated from balance of the vent system.

NOTE:

Machine washing of cargo tanks, referenced in paragraphs B, C, and (3) above, will be accomplished in accordance with the procedures contained in paragraph B.3 of NAVSHIPS 0900-016-0010 "Manual for Cargo Tank Cleaning".

APPENDIX E

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
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	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	[illegible]	JP 4		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	[illegible]	JP 5	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]
	[illegible]			[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
		[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
		[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

1. Explanations for symbols for cargo tank cleaning requirements (see figure 25) are as follows:

   A - No specific preparation is required if lines have been dropped and tanks have been stripped.

   B - Blow out steam-smothering lines and any heating coil lines.

   C - Bottom wash cargo tanks; after dropping lines, hand hose the tank bottoms.

   D - Clean vent lines, machine wash, and gas-free cargo tanks. Close relief valves, fill vent lines with water, and open one valve at a time to flush each line into its respective tank; then, remove all end flanges and allow entire vent line system to drain. Wash each tank with cold water by machine or with other approved system. Open tank tops and ventilate to permit entry for removing scale and hand hosing the bottom. Give particular attention to tanks which previously contained products that were dyed after loading; some dye powder may adhere to bulkheads and underdecks and will contaminate subsequent white product cargoes. After cleaning, strip all tanks and lines. Flush all vent lines between clean cargoes.

   DD - Same as "D" except that hot water shall be used instead of cold. If tank interiors are coated, water temperatures shall not normally exceed 125°F (52°C) unless upgrading from a black to a clean product. A water temperature of 175°F (79°C) may then be used (see 5.8.2.2).

   E - Remove all loose sediment, sludge, and scale. Hand hose tank bottoms in conjunction with removal of sediment, sludge, and scale.

   F - Flush cargo pipelines and pumps. Clean pump strainers. Pump clean water through each pump and pipeline for a minimum of 20 minutes. Carefully remove any oil which may remain at low spots or in bypasses in the pipeline, valves, and strainer boxes. While flushing, use main and stripper pumps simultaneously, opening and closing crossover and bypass valves several times. Clean cargo pump strainers frequently. Flush cargo lines and pumps before and after tank cleaning. Drain all cargo lines upon completion of flushing and dispose of all drainage liquids before loading. (Cargo lines are not coated.)

G - Unless imperative, when converting from black to clean service, do not carry gasoline or jet fuel in a black oil tank without first carrying diesel oil for at least two voyages. If the tanks are coated, however, they may be cleaned for clean oil service immediately after black oil has been carried. Do not load black oil into clean oil vessels unless absolutely necessary. This necessitates a lengthy cleaning procedure before the vessels can be returned to clean oil service.

H - Reject any products which would cause contamination of the succeeding cargo unless, after cleaning, the tanks have carried at least two cargoes of light commercial products and are satisfactory to Government petroleum inspectors.

I - Ships shall not go directly from grain to JP-5 service.

2. Remove all traces of water after cleaning tanks.
3. All safety regulations shall be followed.

APPENDIX F

DESCRIPTION OF MILITARY SPECIFICATION FUELS
BOUGHT BY BULK FUELS DIVISION

JET FUELS:

JP-4: A relatively high volatility naptha-based jet fuel having a low freeze point (-72 degrees F). Used primarily by the Air Force and Army. Designated for high performance aircraft and high altitude flights.

JP-5: A lower volatility fuel than JP-4 used primarily by the Navy. It is a kerosene-based fuel characterized by a high flash point (140 degrees F), which is a safety feature for carrier use.

JP-8: Originally created to be a universally used military jet fuel, having a higher flash point than JP-4 and a lower freeze point than JP-5. This kerosene-based fuel is similar to Jet A-1, but with additives.

Comjet A-1: Commercial jet fuel with a low freeze point, but does not contain the additives required by the military services. The standard commercial jet fuel is Comjet A, which has a higher freeze point.

DIESEL FUELS:

F76/DFW: F76 is a distillate (clean) fuel for Navy ships bunkers with a 140 degree F flash point. DFW is a winter grade of F76 having better cold weather characteristics (pour and cloud points).

DF2/DFA: Ground use diesel engine fuels. DF2 is for use in temperate climates; DFA is for Arctic use.

MG1/MG2: Combat motor gasoline used primarily for war reserves because it has a stability requirement that regular motor gasoline does not have. Used in 3/4 ton trucks, jeeps and gasoline generators. The two grades differ for climate conditions.

MG3/MG4: Combat gasoline bought to the Italian specification (MG3) for storage and use in Italy, and to the Korean specification (MG4) for use and storage in Korea.

MUR/MUP/MUM: Regular unleaded, premium unleaded, and mid-grade unleaded gasolines for use in administrative vehicles.

APPENDIX G

TABLE III. Minimum sampling and testing requirements for petroleum products

SERIAL	LOCATION OF STOCK	TYPE OF STORAGE	WHEN SAMPLED	TYPE OF SAMPLE (SEE NOTE 2)	TYPE OF TEST REQUIRED	REMARKS
1	AT REFINERIES, BLENDING INSTALLATIONS, ETC., ON PROCUREMENT, AND AT OTHER TERMINALS ON ESTABLISHMENT OF NEW BATCHES.	BULK	BEFORE ACCEPTANCE OF NEW MATERIAL AND AFTER ESTABLISHMENT OF NEW BATCH	UPPER, MIDDLE, AND LOWER COMPOSITE, OR ALL LEVEL COMPOSITE.	A	QA, POLICIES AND PROCEDURES FOR PROCUREMENT ARE DIRECTED IN DLAM 4155.1
2	SHORE TANKS AND PIPELINE MAIN DEPOT RECEIVING TANK	BULK	PRIOR TO ISSUE	SAME AS SERIAL 1	APPEARANCE GRAVITY, API COLOR FLASH POINT FILTRATION TIME FSII WATER REACTION (AS APPLICABLE)	STOCKS IN TANKS WHICH HAVE BEEN TESTED PREVIOUSLY WITHIN 90 DAYS NEED ONLY TYPE C REFERENCE SAMPLE WILL BE RETAINED.
3	TANKERS/BARGES LOADING LINES	BULK	DURING LOADING	CONTINUOUS LINE COMPOSITE IAW ASTM 4057	B-1	RETAIN AS REFERENCE ONLY
3a	TANKERS AND BARGES	BULK	AFTER LOADING	ALL LEVELS FROM EACH COMPARTMENT	C	FOR GOVT. OWNED PRODUCT ONLY:
				VOLUMETRIC COMPOSITE OF EACH CARGO ON BOARD	B-1	VESSEL MAY SAIL AFTER TYPE "C" TESTS ARE OK. REMAINDER WILL BE COMPLETED PRIOR ARRIVAL AT DESTINATION
3b	YARD OILERS	BULK	AFTER LOADING	VESSEL CARGO COMPOSITE	API, FLASH, BS & W	NORMALLY YARD OILERS ARE IN DEDICATED SERVICE AND CARRY SHIPS FUELS
4	TANKERS AND BARGES (MULTI-PRODUCT CARGO)	BULK	PRIOR DISCHARGE	ALL LEVEL FROM EACH TANK	C (SEE NOTE 4)	IF ON-SPEC, DISCHARGE AUTHORIZED

TABLE III. Minimum sampling and testing requirements for petroleum products - Continued

SERIAL	LOCATION OF STOCK	TYPE OF STORAGE	WHEN SAMPLED	TYPE OF SAMPLE (SEE NOTE 2)	TYPE OF TEST REQUIRED	REMARKS
				VOLUMETRIC COMPOSITE OF EACH CARGO ON BOARD	B-1	THESE TESTS WILL BE PERFORMED PRIOR TO OR DURING DISCHARGE OF CARGO IN THE EVENT THE CAPABILITY FOR TESTING DOES NOT EXIST AT THE DISCHARGE POINT, A COMPOSITE SAMPLE FROM THE VESSEL WILL BE RETAINED AND TYPE B-1 TESTS PERFORMED ON AN ALL-LEVEL SAMPLE TAKEN FROM THE RECEIVING TANK. IF RECEIVING TANK PRODUCT FAILS SPECIFICATION REQUIREMENTS, TYPE B-1 TESTS WILL BE PERFORMED ON THE RETAINED COMPOSITE SAMPLE TO HELP DETERMINE THE CAUSE OF THE OFF SPECIFICATION PROBLEM.
4a	TANKERS AND BARGES (SINGLE PRODUCT CARGO)	BULK	BEFORE DISCHARGE	COMPOSITE SAMPLE OF SHIP OR BARGE TANKS.	TYPE C	DISCHARGE OF VESSEL IS AUTHORIZED AFTER CONFORMANCE WITH TYPE C TESTS AND THE PROVISIONS OF PARAGRAPH 7.1.6

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1 July 1987

TABLE III. Minimum sampling and testing requirements for petroleum products - Continued

SERIAL	LOCATION OF STOCK	TYPE OF STORAGE	WHEN SAMPLED	TYPE OF SAMPLE (SEE NOTE 2)	TYPE OF TEST REQUIRED	REMARKS
						COMPOSITE SAMPLE WILL BE RETAINED UNTIL RECEIVING TANK ANALYSIS IS COMPLETE. IF RECEIVING TANK PRODUCT FAILS SPECIFICATION REQUIREMENTS, TYPE B 1 TESTS WILL BE PERFORMED ON THE RETAINED COMPOSITE SAMPLE TO HELP DETERMINE CAUSE OF OFF SPECIFICATION PROBLEM.
4b	DOCK/DISCHARGE MANIFOLD HEADER	BULK	DURING DIS-CHARGE	SAMPLE IAW ASTM D-4057, CHAPTER 8.1.7.3 COMMEN-CING ONE HALF HOUR AFTER START OF DIS-CHARGE AND EACH HOUR AFTER UNTIL COMPLE-TION OF DIS-CHARGE ONE HALF QUART EACH. SAMPLE TO BE COMPOSITED AFTER COMPLE-TION OF DIS-CHARGE. ALSO ONE GALLON AT ONE HOUR, MID-POINT, AND ONE HOUR PRIOR COMPLETION, IAW ASTM 2276	RETAIN COMPOS-ITE	RETAIN FOR REFEREE TESTS
					PARTICULATE	SEE NOTE 3 NOTE: FOR BARGE RECEIPTS DIRECTLY INTO A.F. BASES, REFER TO AF TO 42-1

TABLE III. Minimum sampling and testing requirements for petroleum products - Continued

SERIAL	LOCATION OF STOCK	TYPE OF STORAGE	WHEN SAMPLED	TYPE OF SAMPLE (SEE NOTE 2)	TYPE OF TEST REQUIRED	REMARKS
			DURING DISCHARGE	FOR SPLIT CARGO DISCHARGES WHERE ONE PRODUCT IS JP-5, JP-8 OR DFM AND OTHER PRODUCT IS JP-4, MOGAS OR AVGAS A DOCK HEADER SAMPLE WILL BE TAKEN DURING DISCHARGE OF THE JP-5, JP-8 OR DFM ONE HALF HOUR AFTER START OF DISCHARGE AND HOURLY THEREAFTER	FLASH POINT OR EXPLOSIVITY	
						THE VESSEL WILL BE RETAINED AND TYPE B-1 TESTS PERFORMED ON A ALL-LEVEL SAMPLE TAKEN FROM THE RECEIVING TANK. IF RECEIVING TANK PRODUCT FAILS SPECIFICATION REQUIREMENTS, TYPE B-1 TESTS WILL BE PERFORMED ON THE RETAINED COMPOSITE SAMPLE TO HELP DETERMINE THE CAUSE OF THE OFF SPECIFICATION PROBLEM.
4c	TANKERS AND BARGES (SINGLE PRODUCT CARGO)	BULK	BEFORE DISCHARGE	COMPOSITE SAMPLE OF SHIP OR BARGE TANKS.	TYPE C	DISCHARGE OF VESSEL IS AUTHORIZED AFTER CONFORMANCE WITH TYPE C TESTS AND THE PROVISIONS OF PARAGRAPH 7.1.6.

TABLE III. Minimum sampling and testing requirements for petroleum products - Continued

SERIAL	LOCATION OF STOCK	TYPE OF STORAGE	WHEN SAMPLED	TYPE OF SAMPLE (SEE NOTE 2)	TYPE OF TEST REQUIRED	REMARKS
						COMPOSITE SAMPLE WILL BE RETAINED UNTIL RECEIVING TANK ANALYSIS IS COMPLETE. IF RECEIVING TANK PRODUCT FAILS SPECIFICATION REQUIREMENTS, TYPE B-1 TESTS WILL BE PERFORMED ON THE RETAINED COMPOSITE SAMPLE TO HELP DETERMINE CAUSE OF OFF SPECIFICATION PROBLEM.
5	TRANSFERS FROM MAIN INSTALLATIONS (SEE SERIAL 1 TO OTHER INSTALLATIONS)					
5a	AFTER RECEIPT OF FUEL BY PIPELINE SYSTEMS USED FOR MORE THAN ONE PRODUCT.	BULK	AFTER RECEIPT OF FUEL	AS FOR SERIAL 1 (FROM EACH STORAGE TANK)	TYPE B-1	PROVIDED COMPLETE INSPECTION REPORT IS FURNISHED AND AVAIL-ABLE FROM ORIGIN OF SHIPMENT, OTHERWISE TYPE A TESTS WILL BE REQUIRED.
5b	AFTER RECEIPT OF FUEL BY WATERBORNE TRANS-PORT.	BULK	AFTER RECEIPT OF FUEL	AS FOR SERIAL 1 (FROM EACH STORAGE TANK)	TYPE B-1	ALSO JFTOT AFTER JP4/8 RECEIPT BY TANKER.
5c	AFTER RECEIPT OF FUEL THROUGH A DEDICATED SYSTEM.	BULK	AFTER RECEIPT OF FUEL	AS FOR SERIAL 1 (FROM EACH STORAGE TANK)	TYPE C EXCEPT ON INITIAL FIL-LING OR CHANGE OF GRADE THEN TYPE B-1.	
6	TRANSFERS WITHIN IN-STALLATION OR DEPOT.					

TABLE III. Minimum sampling and testing requirements for petroleum products - Continued

SERIAL	LOCATION OF STOCK	TYPE OF STORAGE	WHEN SAMPLED	TYPE OF SAMPLE (SEE NOTE 2)	TYPE OF TEST REQUIRED	REMARKS
6a	BATCHES PREPARED FROM APPROVED BATCH CONSOLIDATED BY TRANSFER THROUGH A DEDICATED SYSTEM.	INSTALLATIONS AND DEPOSITS	AFTER RECEIPT OF FUEL	AS FOR SERIAL 1	TYPE C	SAMPLES WILL BE RETAINED FOR TWO MONTHS FOR REFEREE PURPOSES.
6b	BATCHES PREPARED FROM APPROVED BATCHES CONSOLIDATED BY TRANSFER THROUGH NON-DEDICATED SYSTEMS.	INSTALLATIONS AND DEPOSITS	AFTER RECEIPT OF FUEL	AS FOR SERIAL 1	TYPE B-3 IF AGREED BY INSPECTING AUTHORITY OTHERWISE TYPE B-1	
6c	TRANSFER OF APPROVED BATCHES THROUGH A DEDICATED SYSTEM TO A DEDICATED TANK FOR ROAD OR RAIL LOADING SERVICES.	INSTALLATIONS AND DEPOSITS	AFTER RECEIPT OF FUEL	AS FOR SERIAL 1	TYPE C	DISPOSITION OF SAMPLES SIMILAR TO REMARKS UNDER SERIAL 6(a) ABOVE.
7	DORMANT STOCKS WHEREVER LOCATED.	BULK	PERIODICALLY AS REQUIRED BY TABLE II.	AS FOR SERIAL 1 (SEE REMARKS)	TYPE A OR TYPE B-2 AS APPROPRIATE (SEE REMARK b)	a. SEPARATE SAMPLES; UPPER MIDDLE AND LOWER, SHALL BE TAKEN AND TESTED TO ESTABLISH HOMOGENEITY. IF HOMOGENEOUS THESE SAMPLES SHALL BE MIXED FOR REQUIRED TESTS. b. AT THE DISCRETION OF THE OWNING OR CUSTODIAL AUTHORITY, HAVING REGARD TO TYPE OF PRODUCT, AGE OF STOCK, CONDITIONS OF STORAGE, ETC.
8	FILLING POINTS FOR ROAD AND RAIL TANK CAR CONTAINERS, OR OTHER EQUIPMENT.	BULK	DAILY ON FIRST CONTAINER FILLED AND ON CHANGEOVER TO FRESH FEED TANK.	LINE SAMPLE	TYPE C	APPEARANCE, WATER AND SEDIMENT.

TABLE III. Minimum sampling and testing requirements for petroleum products - Continued

SERIAL	LOCATION OF STOCK	TYPE OF STORAGE	WHEN SAMPLED	TYPE OF SAMPLE (SEE NOTE 2)	TYPE OF TEST REQUIRED	REMARKS
9	IN RAIL TANK CARS AND ROAD TANK VEHICLES AND REFUELERS USED IN OVER THE ROAD TRANSPORT.	BULK	BOTH AFTER LOADING AND BEFORE DISCHARGE.	ALL LEVEL SAMPLE FROM THE RAIL CAR OR VEHICLE.	TYPE C	IN THE CASE OF COMPARTMENTED VEHICLES, A SAMPLE FROM EACH COMPARTMENT IS TO BE CHECKED. ENSURE SEALS ARE INTACT.
10	TRANSFERS BY PIPELINE.	BULK	AFTER PASSING OF INTERFACE AND ONE HOUR BEFORE ESTIMATED STOPPING.	LINE SAMPLE	TYPE C	
11	TANKS CONTAINING INTERFACE MIXTURES FROM PIPELINE FOR RE-INJECTION	BULK	BEFORE RE-INJECTION	AS FOR SERIAL 1	TYPE B-3	RE-INJECTION OF INTERFACE PRODUCTS IS TO BE UNDER THE TECHNICAL CONTROL OF THE PIPELINE AUTHORITY OR IAW WITH O.A
12	PACKAGED FUEL STOCKS WHEREVER LOCATED	PACKAGED	(a) PERIODICALLY AS REQUIRED BY TABLE II (SEE REMARK (a)) (b) WHEN CONTAMINATION OR DETERIORATION OF PRODUCT OR CONTAINER IS SUSPECTED (c) WHEN IDENTITY IS UNCERTAIN.	REPRESENTATIVE SAMPLE (ASTM D-4057)	TYPE B-2 (SEE NOTE 4)	a. WHERE AN AGREED INSPECTION PERIOD HAS NOT BEEN STIPULATED THE PRODUCT IS TO BE INSPECTED AT LEAST ANNUALLY
13	REFUELER TRUCKS SKID MOUNTED REFUELERS OR OTHER DISPENSING EQUIPMENT	BULK	(a) DAILY (b) MONTHLY	LINE SAMPLE NOTE: AFTER RECIRCULATION OF FUEL	(SEE REMARKS AND NOTE 3)	a. VISUAL CHECK FOR APPEARANCE, WATER AND SEDIMENT.

TABLE III. Minimum sampling and testing requirements for petroleum products - Continued

SERIAL	LOCATION OF STOCK	TYPE OF STORAGE	WHEN SAMPLED	TYPE OF SAMPLE (SEE NOTE 2)	TYPE OF TEST REQUIRED	REMARKS
						b. LABORATORY ANALYSIS FOR WATER AND SEDIMENT.

LEGEND:

TYPE "A" TEST - Complete specification inspection tests.

TYPE "B-1" TEST - Partial analysis comprising the checking of principal characteristics most likely to have been affected in the course of moving the product.

TYPE "B-2" TEST - Partial analysis to verify characteristics susceptible to deterioration because of age.

TYPE "B-3" TEST - Partial analysis for contamination; in particular, for controlling the re-injection of pipeline interface products.

TYPE "C" TEST - Specific gravity, color, and appearance, including visible sediment and water.

NOTE (1): For further details, see the tables for the types of test required on the various products (Table IV).

NOTE (2): The methods of sampling to be used are those prescribed by the ASTM (see Chapter 5).

NOTE (3): When laboratory tests of material from dispensing and handling equipment evidence free water or a sediment level exceeding 1.0 milligrams per liter of fuels, that equipment shall be resampled and deadlined pending laboratory confirmation of the initial results. If the second laboratory analysis confirms the presence of free water or a sediment content exceeding 1.0 milligrams per liter, improvement in fuel quality must be made (for the Navy, 2.0 milligrams per liter applies).

NOTE (4): No receiving tests are necessary on packaged products provided the containers are intact and markings adequately identify the product.

NOTE (5): The average particulate content of the 3 fuel samples should not exceed 8mg/gal however, the first and last samples are obtained under severe discharge conditions and may show high particulate content. Solid contamination while extremely objectionable is a physical contaminant which can be removed under proper conditions with proper equipment and since the product at this point is government owned, discharge operations will not be discontinued for this reason. The contracting officer, defense fuel supply center and the quality assurance representative at the loading point will be advised however of any high particulate results obtained, for future planning purposes and possible cleaning action necessary to the vessel involved. This note is not applicable to internal Navy transfers.

NOTE (6): Where flash point tests are required, a vessel composite(s) shall be run in lieu of each individual tank.

APPENDIX H

TABLE IV-A. Types of tests required on gasoline, aviation

PROPERTIES	TYPE B-1 TEST	TYPE B-2 TEST	TYPE B-3 TEST	TYPE C-TEST
WATER AND SOLIDS (VISUAL) 1/	X	X	X	X
SOLIDS (MILLIPORE)	X	X	X	-
COLOR (VISUAL)	X	X	X	X
SPECIFIC OR API GRAVITY	X	X	X	X
DISTILLATION	X	X	X	-
COPPER STRIP CORROSION	X	X	X	-
EXISTENT GUM	X	X	-	-
REID VAPOR PRESSURE	X	X	-	-
WATER REACTION	X	X	X	-
LEAN MIXTURE RATING 2/	X	X	X	-
RICH MIXTURE RATING 2/	X	X	-	-
LEAD CONTENT	X	X	-	-
POTENTIAL GUM	-	X	-	-

1/ Obtain sample in a clear round one quart glass bottle, swirl the bottle vigorously so a vortex is formed. Visually check for sediment at the point of the vortex. If sediment is visible, a spot larger than 3mm diameter indicates corrective action should be taken to prevent the delivery of contaminated fuel.

2/ If the capability does not exist to perform this test at the terminal, a sample will be sent to the nearest service laboratory that does have the capability. In the event operational necessity dictates issue of product before results are obtained from the service laboratory, shipments may be made. However when laboratory results indicate failure on a recurring basis, notify DFSC-QA.

TABLE IV-8. Types of tests required on aircraft turbine fuels

TEST REQUIREMENTS	TYPE B-1 TEST	TYPE B-2 TEST	TYPE B-3 TEST	TYPE C-TEST
WATER AND SOLIDS (VISUAL) 1/	X	X	X	X
COLOR (VISUAL)	X	X	X	X
SPECIFIC OR API GRAVITY	X	X	X	X
SOLIDS (MILLIPORE)	X	X	X	-
DISTILLATION	X	X	X	-
COPPER STRIP CORROSION	X	X	X	-
FREEZING POINT	X	X	X	-
EXISTENT GUM	X	X	X	-
REID VAPOR PRESSURE (JP-4 ONLY)	X	X	X	-
FLASH POINT (EXCEPT JP-4)	X	X	X	X
WATER REACTION	X	X	X	-
LEAD CONTENT (IF CONTAMINATION WITH LEADED FUELS IS SUSPECTED)	X	X	X	-
FUEL SYSTEM ICING INHIBITOR	X	X	X	-
FILTRATION TIME (JP-4 & 8)	X	X	X	-
WATER SEPARATION INDEX 2/ 3/ (JP-4 & 8)	X	X	X	-
CONDUCTIVITY (JP-4 AND JP-8) 4/	X	X	X	-
THERMAL STABILITY	-	X	-	-
COLOR (SAYBOLT)	-	X	-	-
ACID NUMBER	-	X	-	-
PEROXIDE NUMBER (JP-5)	-	X	-	-

1/ Clean and bright and free of undissolved water. Obtain sample in a clear round one quart glass bottle, swirl the bottle vigorously so a vortex is formed. Visually check for sediment at the point of the vortex. If sediment is visible, a spot larger than 3mm diameter indicates corrective action should be taken to prevent the delivery of contaminated fuel.

2/ If the capability does not exist to perform this test at the terminal, a sample will be sent to the nearest service laboratory that does have the capability. In the event operational necessity dictates issue of product before results are obtained from the service laboratory, shipments may be made, however when laboratory results indicate failure on a recurring basis, notify DFSC-QS.

3/ Water separation index, modified testing is not performed if the fuel contains conductivity additive.

4/ If fuel contains conductivity additive, CU readings should be taken within two minutes of sampling.

MIL-HDBK-200G
1 July 1987

TABLE IV-C. Types of tests required on gasoline, automotive

TEST REQUIREMENTS	TYPE B-1 TEST	TYPE B-2 TEST	TYPE B-3 TEST	TYPE C-TEST
APPEARANCE	X	X	X	X
WATER AND SOLIDS (VISUAL)	X	X	X	X
COLOR (VISUAL)	X	X	X	X
SPECIFIC OR API GRAVITY	X	X	X	X
DISTILLATION	X	X	X	-
REID VAPOR PRESSURE	X	X	-	-
COPPER STRIP CORROSION	-	X	X	-
UNWASHED GUM	-	X	1/ X	-
KNOCK RATING (RON AND MON)	2/ X	X	2/ -	-
OXIDATION STABILITY	-	X	[illegible]	-
LEAD CONTENT	-	-	[illegible]	-
WATER TOLERANCE 3/	X	X	[illegible]	-

1/ Unwashed gum, without solvent wash, shall not incr~~ease by more than~~n 2 mg as compared to the original product. In the event of gum increase exceeding 2 mg. A type test, as defined in the legend, will be run.

2/ In the case of pipeline, this shall be done when considered necessary.

3/ Gasohol only.

TABLE IV-D. Types of tests required on diesel fuels and kerosene 1/

TEST REQUIREMENTS	TYPE B-1 TEST	TYPE B-2 TEST	TYPE B-3 TEST	TYPE C-TEST
APPEARANCE	X	X	X	X
COLOR	X	2/ X	X	(VISUAL) X
SPECIFIC OR API GRAVITY	X	X	X	X
DISTILLATION	X	X	-	-
FLASH POINT	X	X	X	X
CARBON RESIDUE (DIESEL FUEL ONLY)	X	X	-	-
CLOUD POINT	-	X	-	-
POUR POINT	-	X	-	-
CORROSION	-	X	-	-
CETANE INDEX	-	X	-	-
VISCOSITY	-	X	-	-
WATER & SEDIMENT BY CENTRIFUGE	-	X	-	-
PARTICULATE (VV-F-800 & F-76)	X	2/ X	-	-
ACCELERATED STABILITY 2/	-	X	-	-
SULFUR 4/	-	3/ X	-	-

1/ When specified.

2/ May be tested with field fuel quality monitor if available (VV-F-800 only).

3/ Kerosene. Grade 1K only, if intended for nonflue connected burner.

4/ Test to be performed if equipment is available.

TABLE IV-E. Types of tests required on burner fuels 1/

TEST REQUIREMENTS	TYPE B-1 TEST	TYPE B-2 TEST	TYPE B-3 TEST	TYPE C-TEST
FLASH POINT	X	X	X	X
BS AND W (CENTRIFUGE)	X	X	X	X
VISCOSITY	X	X	-	-
ASH	-	X	-	-
CARBON RESIDUE	X	-	-	-
SEDIMENT BY EXTRACTION	-	X	-	-
POUR POINT	-	X	-	-

1/ When specified.

APPENDIX L

FACSIMILE TRANSMITTAL SHEET

Military Sealift Command
Washington Navy Yard, Bldg. 210
Washington, D.C. 20398-5100

DATE: 07/19/93

FROM: COMSC WASHINGTON DC//N312// LEO SPANO

Phone: (202) 433 - 0067/0073 /Autovon: 288 -

FAX: (202) 433 - ~~7502~~ [illegible] /Autovon: 288 -

Total Pages Transmitted (including this page):

TO: DEFENSE FUEL SUPPLY CENTER//QE//

Phone: 703-274-7441 /FAX: 703-274-6975

SUBJ: MV SAMUEL L. COBB REQUEST FOR GAS FREE WAIVER

1. MV SAMUEL L COBB DISCH JP8 CARGO CC3305 IN CHIMUWAN ON 24 JUL. THEN THE SHIP LOADS JP8 CARGO CC3219 IN ONSAN FOR DISCH IN SASEBO.

2. REQUEST GAS FREE WAIVER FOR LOADING CARGO CC3219.

3. GAS FREE WAIVER WILL RESULT IN FOLLOWING SAVINGS TO THE GOV'T

CAPITOL AND OPERATIONAL HIRE FOR 1 1/2 EXTRA DAYS ATSEA TO TANK CLEAN AND GAS FREE TANKS	40,957
EXTRA FUEL & LUBE	7,500
DISPOSAL OF SLOPS	15,000
TOTAL SAVINGS	63,457

Leo Spano

LEO SPANO

MSC 5272/1 (8-90)

APPENDIX M

06 04 93 09:18 202 433 0539 MSC FAO

703 274 4795

MAR 5 '93 13:06 FROM DFSC-Q TO MSC PAGE.001

CAMERON STATION ALEXANDRIA, VIRGINIA 22304-6160
FACSIMILE TRANSMISSION COVER SHEET DFSC-Q FACSIMILE TELEPHONE NUMBER (703) 274-6705 OR AUTOVON 284-6705 SECURE FACSIMILE TELEPHONE (703) 274-3362 OR AUTOVON 284-3362
TO: MSC WASHINGTON ATTENTION: LEO SPANO, TANKER BRANCH M312 — FROM: DFSC-QER (JUAN C. BARCINAS) DSN 284-7441 TELEPHONE NUMBER: (703) 274-7441
DESCRIPTION OF DOCUMENTS: USNS SEALIFT CHINA SEA REQUEST FOR GAS FREE WAIVER
CLASSIFICATION OF DOCUMENTS BEING TRANSMITTED: UNCLASSIFIED
TOTAL NUMBER OF PAGES, INCLUDING COVER SHEET: 1

MESSAGE: LEO, 02 MAR 93

1. REFERENCE MSC FAX DATED 23 FEB 93, SUBJECT AS ABOVE.

2. SUBJECT GAS FREE WAIVER REQUEST TO LOAD F76 CARGO CC3349 INCHON FOR DISCHARGE GUAM AFTER LOADING JP5 CARGO CC3031 OKSAN AND DISCHARGING CHINCWAN IS DENIED. DISPARITY IN FLASH POINT OF JP5 AT 100 DEGREES AND F76 AT 140 DEGREES WOULD CONTAMINATE THE F76 CARGO FOR GUAM.

COPY TO:
DFSC-QI
DFR PAC TECH MGR
DCMAOR KOREA
NSD GUAM CODE 700

JUAN C. BARCINAS
PRODUCT QUALITY DIVISION
DIRECTORATE OF QUALITY ASSURANCE
AND TECHNICAL OPERATIONS

APPENDIX N

04 93 09:17 ☎202 433 0599 MSC PAO 2014
703 274 8795
APR 12 '93 12:27 FROM /SC-Q TO PAGE.001

Defense Logistics Agency

3121
A
B
CoR
DGm

In reply
Refer to DFSC-QEC

12 APR 1993

SUBJECT: Request for Gas-Free Waiver

Place in file

TO: Military Sealift Command
Attn: Larry Riley
Washington, D. C. 20398-5100

1. Reference your FAX of 08 APR 93, subject as above.

2. Your request for a Gas-Free waiver is approved for the Sealift Antarctic loading of Cargo SC-3239, ETA 19 APR 93 (ex-DFSP San Pedro/Long Beach, CA; 140,000 Bbls F-76; dest. Puget Sound, WA, 24 APR 93). This is after vessel has discharged Cargo SC-3167 (load Shell, Pt. Molate, CA, 15 APR 93; 185,000 Bbls JP-5; dischg. San Diego, CA, 17 APR 93). This is contingent with no problems during the JP-5 discharge at San Diego.

3. Final determination for suitability to Load rests with the loading Quality Surveillance Representative at DFSP San Pedro/ Long Beach, CA, based upon their cargo tank inspection from the deck.

4. Cargo tanks and lines shall have been drained prior to arrival. Should cargo tanks be found unsuitable to load, the vessel will be required to clean and gas-free. All other vessel inspection criteria remain unchanged.

5. Block 28 of the DD Form 250-1 Loading Report shall be annotated if vessel is found suitable to load by deck inspection to read, "Vessel cargo tanks determined suitable to load based on visual inspection from the deck per waiver granted by DFSC-QEC, 12 APR 1993.

6. POC for this office is Glenn Rowinski, DSN 284-7441; comm.: 703-274-7441.

cc:
DFR-West
Attn: Mike Koury
Mary Lynn Osborne

Glenn A. Rowinski
GLENN A. ROWINSKI
Product Quality Division
Directorate of Quality Assurance
and Technical Services

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